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telecommunication journal

MONTHLY MAGAZINE OF THE INTERNATIONAL
TELECOMMUNICATION UNION — APRIL 1974

SUPPLEMENT: Table of artificial satellites launched in 1973

ARCHIVES
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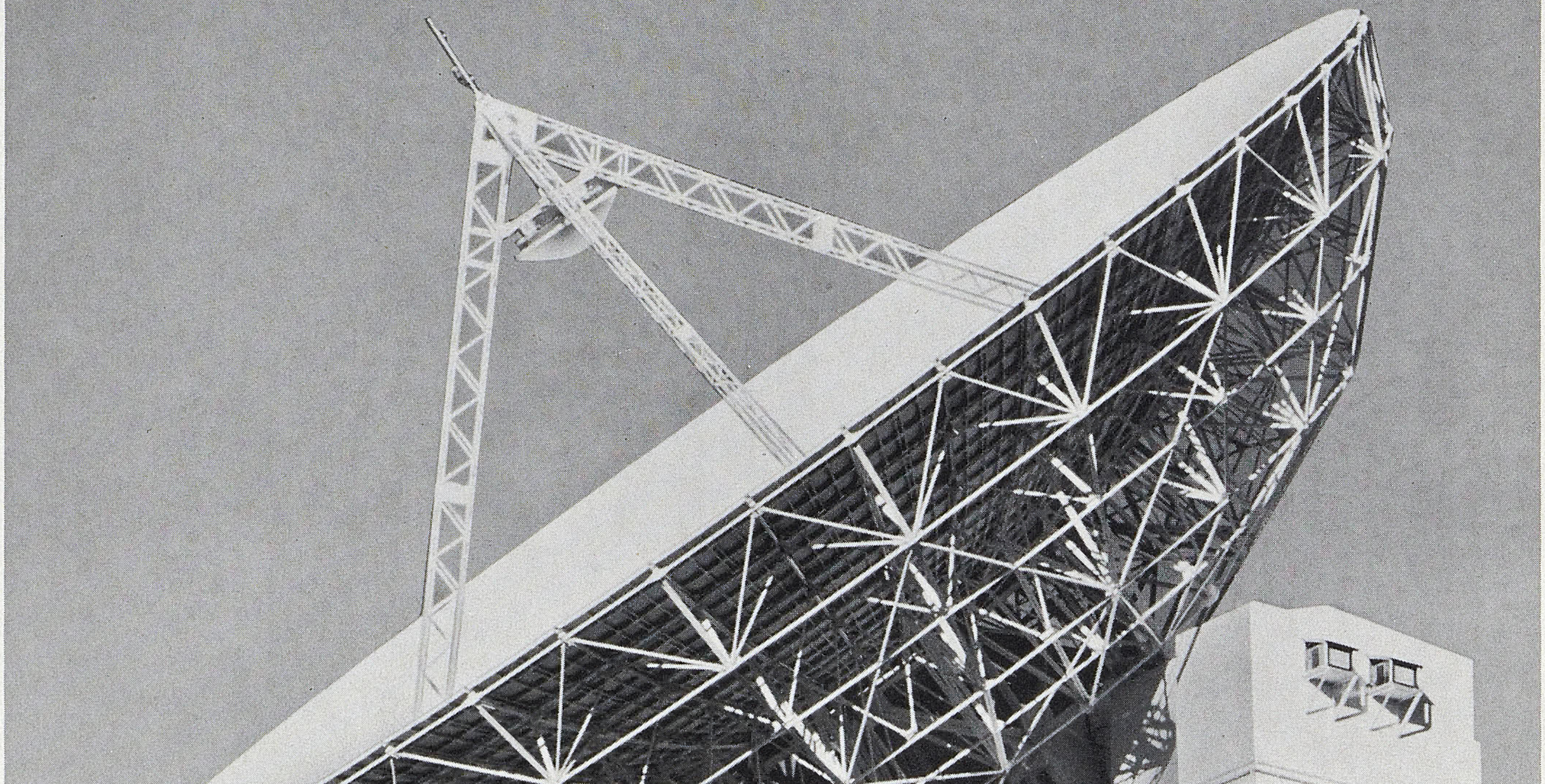
GENÈVE

NEC... A COMMUNICATIONS COMPANY (with 48 earth stations to prove it)

NEC has built from scratch, or supplied and installed equipment for forty-eight earth stations, fifteen of them using SPADE (Single channel per carrier PCM multiple Access Demand assignment Equipment).

Engineers and communications specialists involved in satellite communications have come to rely on NEC-built subsystem equipment: antenna, low-noise receivers, threshold extension demodulators and multiplex-demultiplex equipment.

We gladly admit that while making the world smaller we have made ourselves larger: spin-off from these earth-space ventures means technical know-how that gets incorporated into the latest NEC communications equipment.



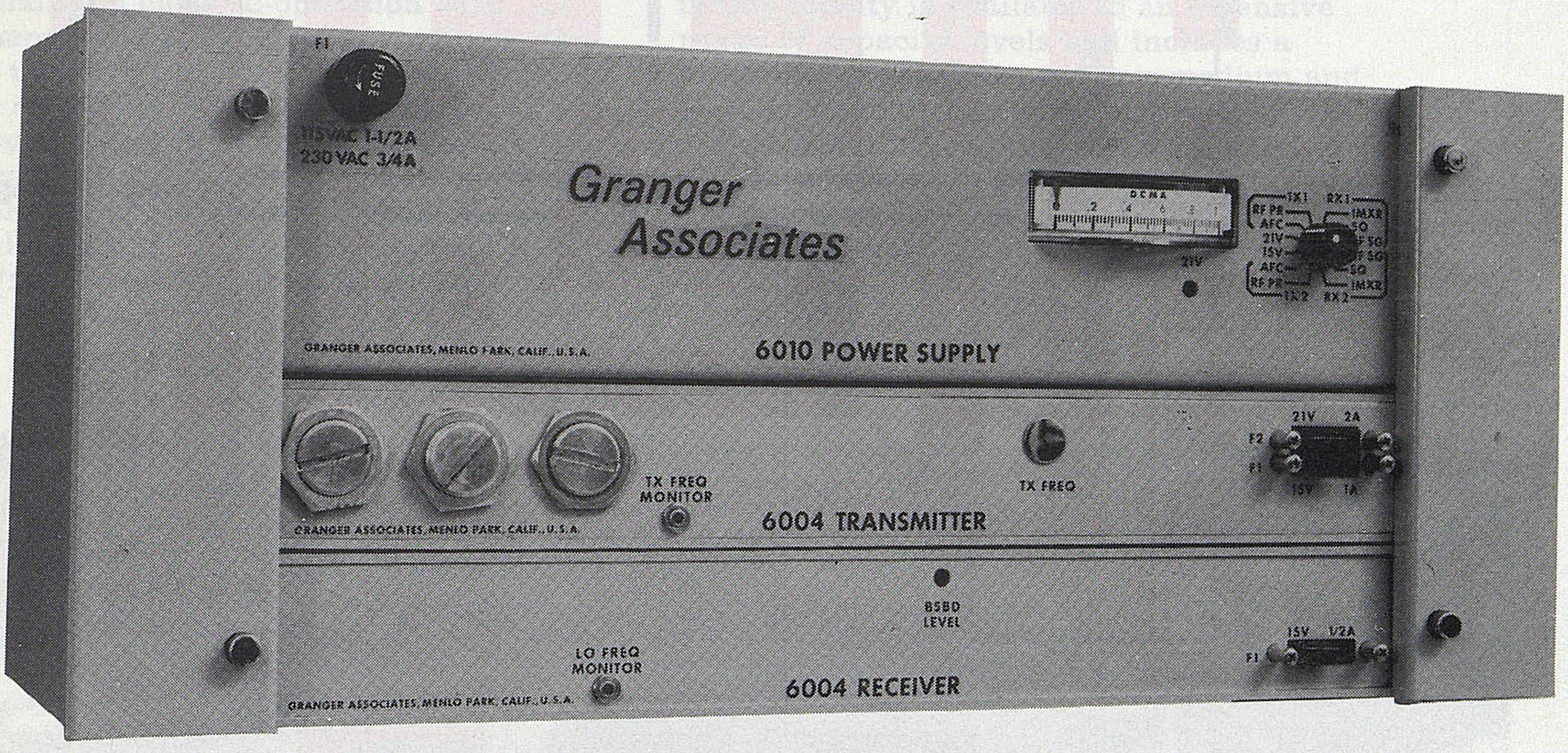
NEC earth station at Warkworth in New Zealand

NEC
Nippon Electric Co., Ltd.
Tokyo, Japan

Main Products: electronic computers, data communication systems, telephone systems, carrier transmission, radio communication, radio & television broadcasting, satellite communications equipment, electrical household appliances, other applied electronic equipment, and electronic components.

MEET GRANGER'S

178mm 400-MHz UHF RADIO


F1
FUSE
115VAC 1-1/2A
230VAC 3/4A
Granger Associates
DCMA
21V
1X1
RX1
RF PR
AFC
21V
15V
AFC
RF PR
1X2
IMXR
SO
SO
IMXR
RX2
GRANGER ASSOCIATES, MENLO PARK, CALIF., U.S.A.
6010 POWER SUPPLY
TX FREQ MONITOR
TX FREQ
21V
2A
F2
F1
15V
1A
GRANGER ASSOCIATES, MENLO PARK, CALIF., U.S.A.
6004 TRANSMITTER
BSBD LEVEL
LO FREQ MONITOR
15V
1/2A
F1
GRANGER ASSOCIATES, MENLO PARK, CALIF., U.S.A.
6004 RECEIVER

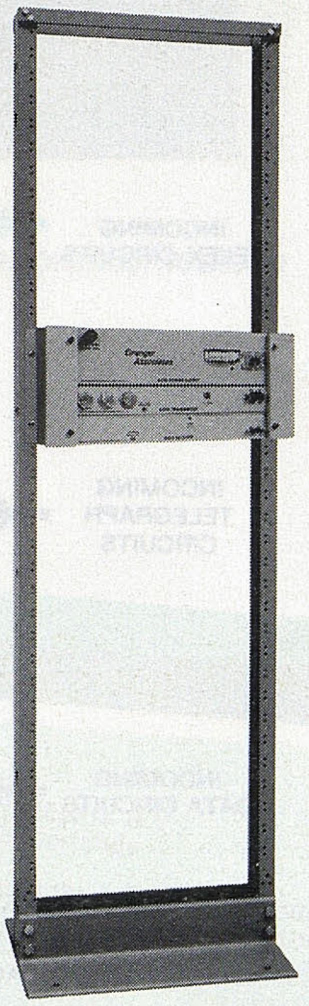
Don't let its size fool you. The basic design is a completely solid-state radio operating in the 380 to 470 MHz band, meeting CCIR long haul noise objectives for microwave circuits with performance to spare.

This radio is supplied with either 24 or 60 channel capacity plus a full choice of customer options. Hot-standby and diversity configurations are available, with continuity pilot, remote alarm output, and squelch as standard features. Also standard, of course, are other features that have made Granger equipment so outstanding: rugged construction, reliability, and low power drain. That's why Granger terminals operate continuously on remote mountain tops with only annual inspection.

Granger 400-MHz equipment is ideally suited for low-density transmission of voice, data and supervisory and control functions over long or short-haul, trunk and spur routes. The system lends itself to a wide range of applications for governmental, utilities, industrial, and commercial requirements. Specialized applications include broadcast studio-transmitter links, railroad signaling, detection, track-control, and data transmission from remote locations.

With modern, reliable equipment like this available, the 400-MHz band may be the answer to your problems. And if your experience has been with higher frequencies, you'll be pleasantly surprised at the ease of installation and low cost of a G/A 400-MHz system.

There are a lot of good reasons why G/A microwave systems are the accepted standard in a variety of applications throughout the world. No matter what you need in a 200, 400 or 900 MHz point to point radio or in CCITT compatible multiplex, bring your requirements to Granger Associates. Call or write today.



Granger Associates

Granger Associates: 1360 Willow Road, Menlo Park, California 94025;
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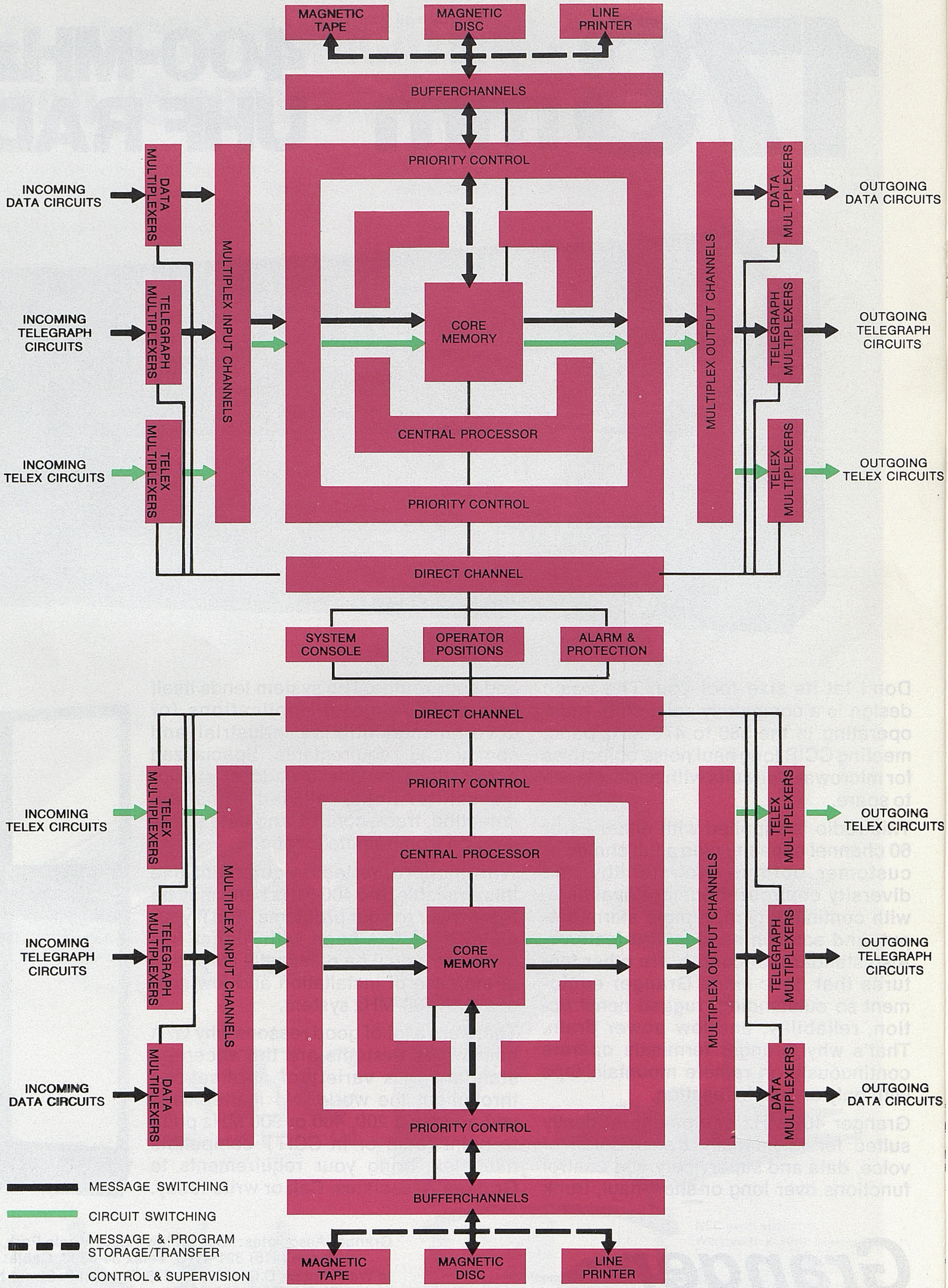
MAGNETIC TAPE
MAGNETIC DISC
LINE PRINTER
BUFFERCHANNELS
PRIORITY CONTROL
INCOMING DATA CIRCUITS
DATA MULTIPLEXERS
INCOMING TELEGRAPH CIRCUITS
TELEGRAPH MULTIPLEXERS
INCOMING TELEX CIRCUITS
TELEX MULTIPLEXERS
MULTIPLEX INPUT CHANNELS
CORE MEMORY
CENTRAL PROCESSOR
PRIORITY CONTROL
MULTIPLEX OUTPUT CHANNELS
DATA MULTIPLEXERS
OUTGOING DATA CIRCUITS
TELEGRAPH MULTIPLEXERS
OUTGOING TELEGRAPH CIRCUITS
TELEX MULTIPLEXERS
OUTGOING TELEX CIRCUITS
DIRECT CHANNEL
SYSTEM CONSOLE
OPERATOR POSITIONS
ALARM & PROTECTION
DIRECT CHANNEL
PRIORITY CONTROL
INCOMING TELEX CIRCUITS
TELEX MULTIPLEXERS
INCOMING TELEGRAPH CIRCUITS
TELEGRAPH MULTIPLEXERS
INCOMING DATA CIRCUITS
DATA MULTIPLEXERS
MULTIPLEX INPUT CHANNELS
CENTRAL PROCESSOR
CORE MEMORY
PRIORITY CONTROL
MULTIPLEX OUTPUT CHANNELS
TELEX MULTIPLEXERS
OUTGOING TELEX CIRCUITS
TELEGRAPH MULTIPLEXERS
OUTGOING TELEGRAPH CIRCUITS
DATA MULTIPLEXERS
OUTGOING DATA CIRCUITS
BUFFERCHANNELS
MAGNETIC TAPE
MAGNETIC DISC
LINE PRINTER
MESSAGE SWITCHING
CIRCUIT SWITCHING
MESSAGE & PROGRAM STORAGE/TRANSFER
CONTROL & SUPERVISION

Combining message-switching with circuit-switching demands an integrated system capability

Philips maintain close co-operation with governmental and private carriers all over the world in the design of switching systems. This has resulted in a well-proven, high-reliability message and circuit switching facility with standard software packages for public telegraphy, telex and ATA/IATA (leased channels).
The DS 714 processor-controlled switcher used in this facility is available in an extensive range of capacity levels and includes a hierarchy of sophisticated low, medium and high speed multiplex equipment.
In addition, Philips provide a complete family of computer-based concentrators and remote multiplexers for efficient, flexible and economical network organisation.

PHILIPS

In addition to the subject presented, Philips Telecommunicatie Industrie are pulling their weight in other fields of telecommunications. Their production programme is laid down in a series of booklets dealing with:

- Telegraph and Data Switching
- Public Telephone Systems
- Private Telephone Systems
- Telephone Transmission
- Telegraph and Data Transmission
- Radiocommunications and navigational aids
- Mobile Radio

PHILIPS Telecommunication

Philips' Telecommunicatie Industrie B.V.
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We can keep you in touch out here.

Time and space are the great gulfs that keep people apart. We bridge them for you with the here and now of telecommunication. Out there.

These days telecommunication is more than sending a telex or a telegram or dialling a phone call. The companies who are making the going multi-nationally use integrated, purpose-built *telecommunications systems.*

These companies have outgrown standard facilities. They've discovered that the effective management of their affairs around the world requires specially designed telecommunications links. They get immediate access, anywhere. In total security. And it usually costs them less money than existing piecemeal communications.

We design and maintain telecommunications systems, but we don't build equipment. So there is no constraint to use anything less than the optimum for the job in hand. If it doesn't exist, we have someone build it for you.

Ask your director in charge of telecommunications about us. If you don't have one, perhaps you should. Give us the job.

The Cable and Wireless Group of Companies and Associates, with offices around the world.

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PCM

Economy

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A new Hasler PCM-generation:
CCITT & CEPT-conform
30+2 channels
2,048 Mbit/s; HDB-3 code

CH-30

Extension capability to match:
customer's wishes
size of project
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Transmission variety for:
cable and radio links
analog and digital data
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Minimal costs owing to:
flexibility and build-out facility
simple maintenance
compact design

Sketch your requirements– we realize your PCM-link!

Hasler

Hasler AG
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3000 Bern 14, Schweiz
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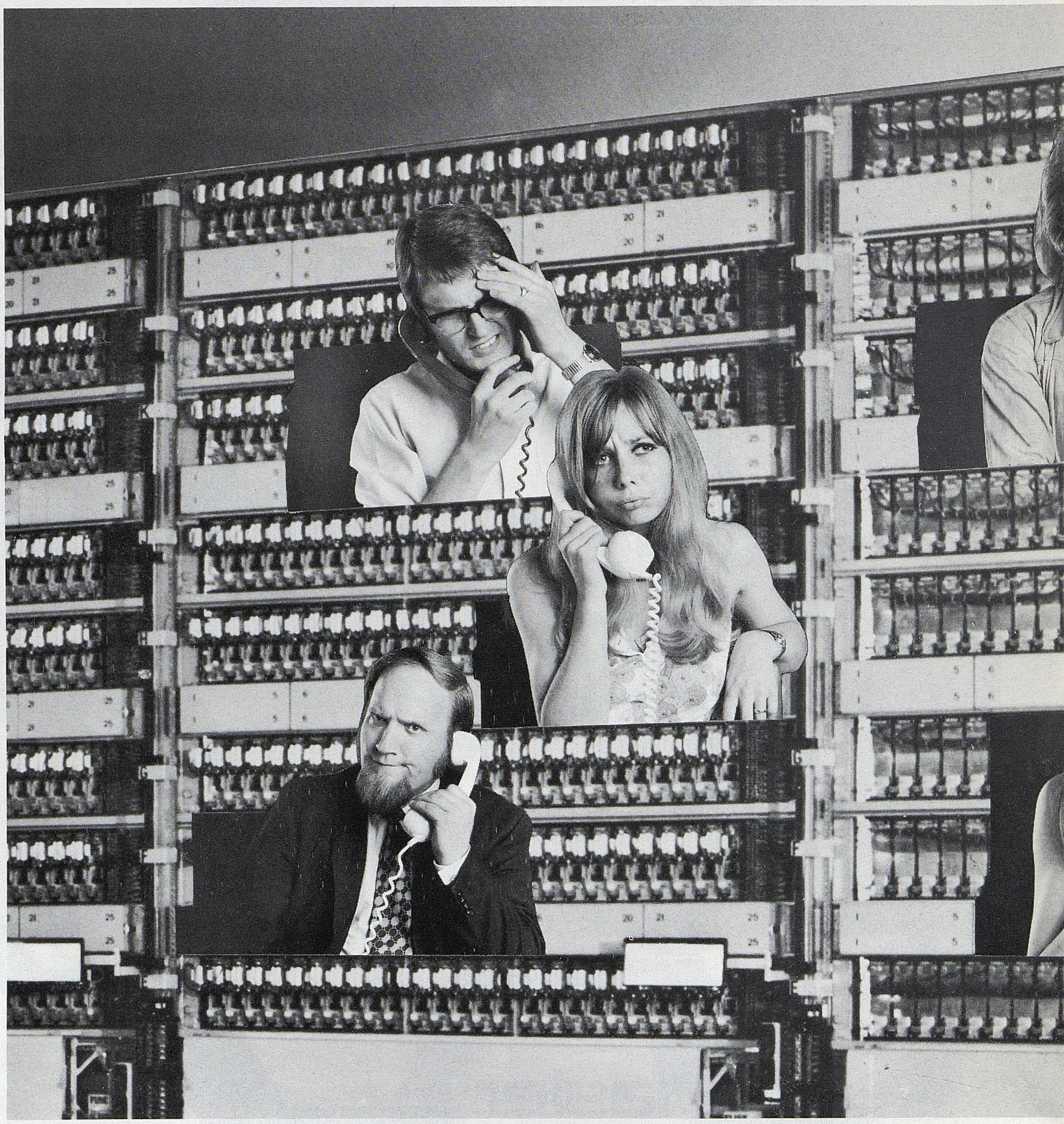
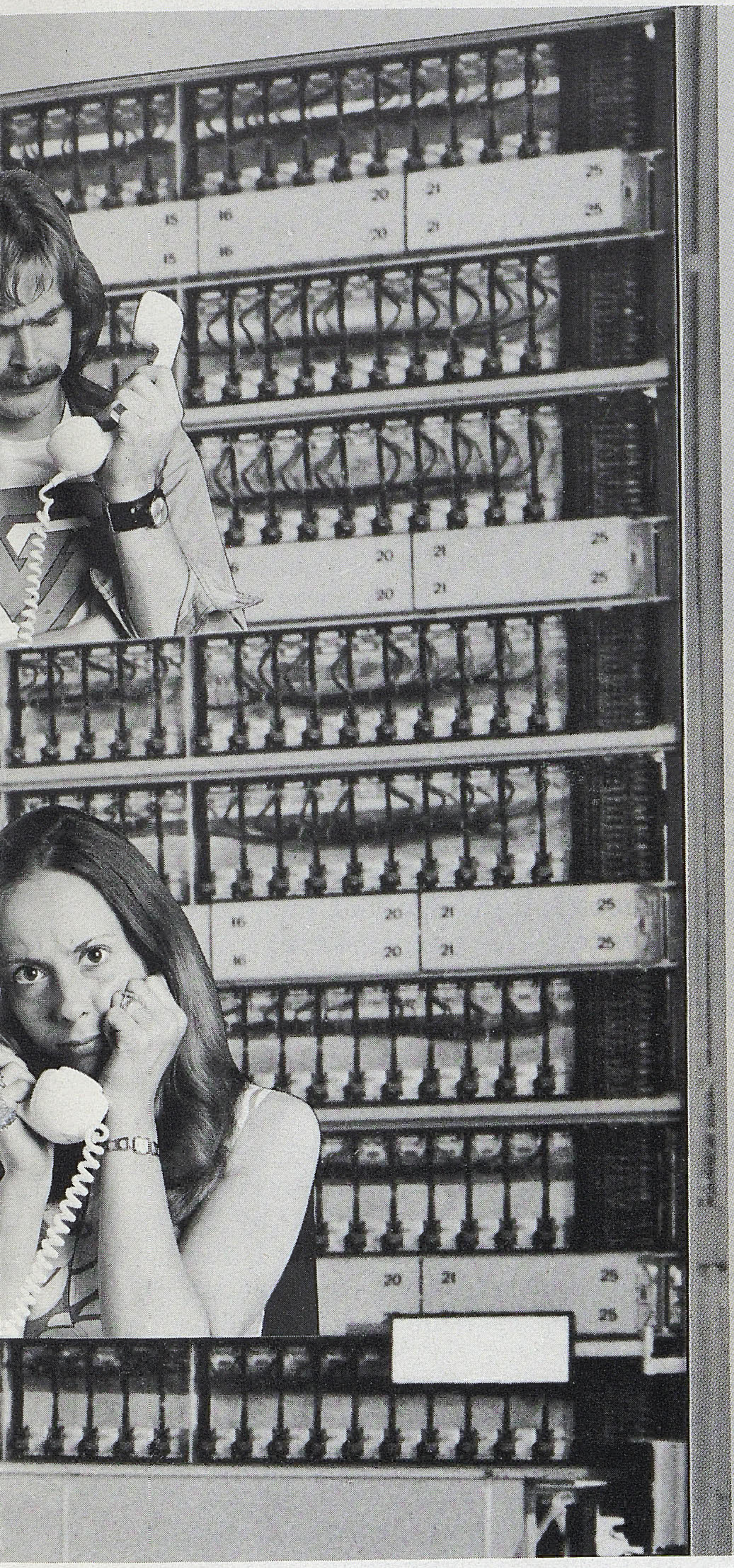
Is your exchange



* A Trademark of the ITT System

a waiting room?



Your subscribers know the problem. Time wasted waiting for calls. Then they finally get through and find themselves in the middle of a three-way conversation. Or connected to the wrong number. Or sometimes they don't get through at all.

With Metaconta*, ITT's new electronic switching system, your subscribers don't have any of these problems. Instead they get the wide range of facilities that Metaconta provides. Because with program control Metaconta establishes and transfers communications with maximum speed and reliability.

And it's this speed which provides completely new features—like abbreviated dialling, conference calls and call transfer. Plus all the other features you'd expect. Push-button dialling, absentee service, alarm calls and call restriction. All automatic. All improving the service.

And you benefit from a centralised charging and recording facility. Automatic re-routing. And a centralised fault locator for easy observation, maintenance and service.

Much of Metaconta's flexibility derives from ITT processors—the ITT 3200 for high traffic exchanges and the ITT 1600 for low traffic—operating according to ITT's unique load sharing principle.

Metaconta's modular construction means easy on-site maintenance. And utilizing Uniswep, ITT's new equipment practice, its design is extremely simple and compact.

The Metaconta system is the system of the future—already making a name for itself now in Belgium, France, Morocco, Mexico and Australia. And it's backed by the worldwide experience and servicing facilities of ITT.

ITT

SCIENCE/SCOPE

Japan's new geostationary meteorological satellite will make TV-like images of cloud formations over one-third of the earth to warn scientists of potentially perilous storms. Its camera will operate in darkness as well as daylight, taking pictures every 20 minutes. The GMS, scheduled for launch from Cape Canaveral in 1976, will be built for Japan's National Space Development Agency by Hughes and Nippon Electric Co. Japan will use it to participate in the Global Atmospheric Research Program.

Three companies exploring northern Canada for new oil reserves are conducting communications experiments and are linked with home offices in Calgary, some 2,000 miles away, by Telesat Canada's Anik communications satellite. They are using a transportable earth station with a 10-foot dish antenna to send and receive voice, data, and teletype communications. The station has the capability for 12 voice channels. It can be erected and put into operation within eight hours. Both the satellite and the earth station were built by Hughes.

The best pictures ever taken of Jupiter were made by the imaging photopolarimeter (IPP) aboard Pioneer 10 and sent a half-billion miles by radio to NASA's Ames Research Center at Mountain View, CA. They clearly show the Great Red Spot and -- because the immense gravity caused Pioneer 10's trajectory to curve around Jupiter as it sped to escape the solar system -- include views from angles that cannot be seen from earth. Pioneer 10's infrared radiometer returned data on Jupiter's net energy flux and the thermal structure and chemical composition of its atmosphere. Both instruments were built by Santa Barbara Research Center, a Hughes subsidiary.

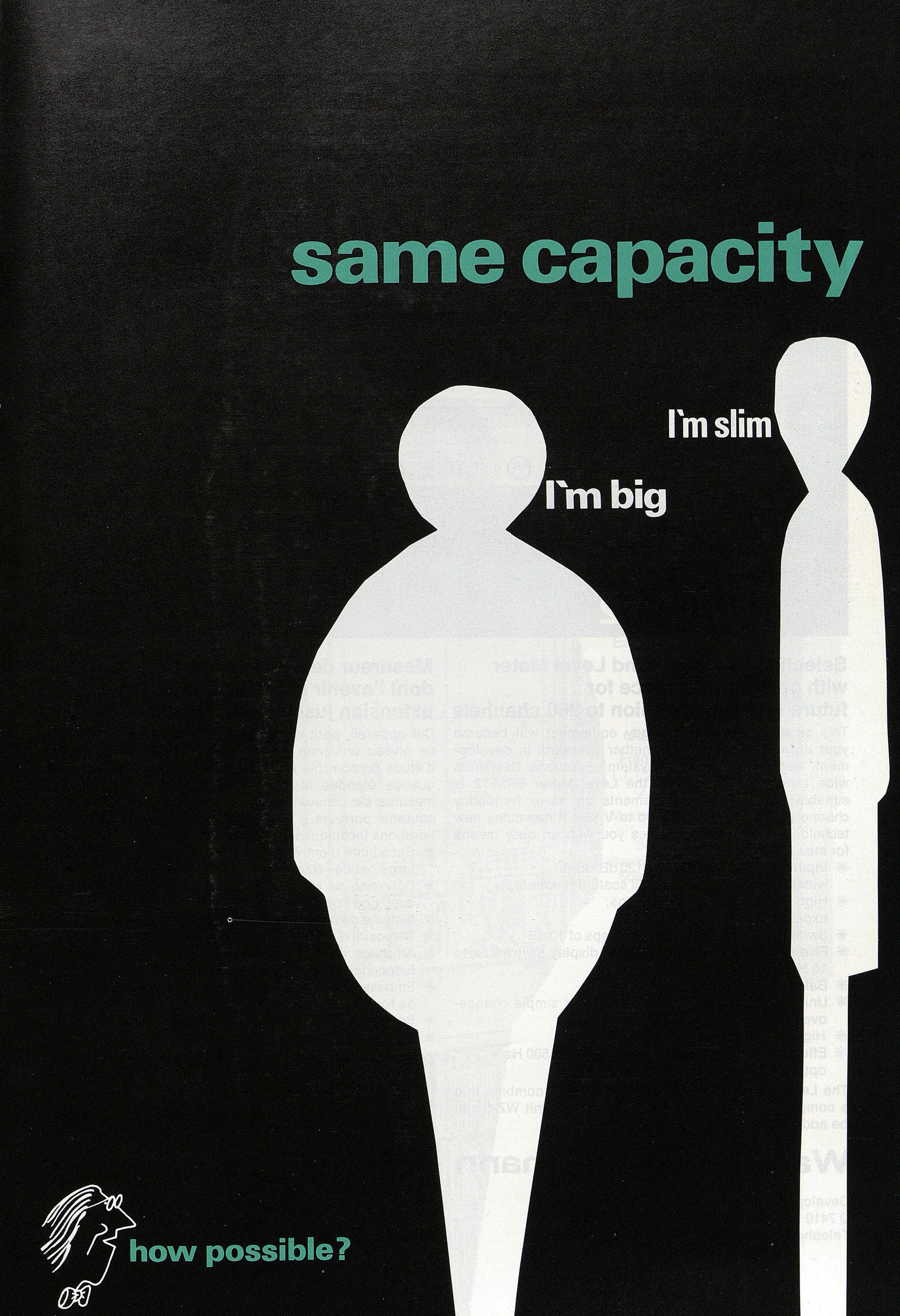
Testing of the world's first maritime satellite and its antenna system is now under way in a new anechoic test chamber at Hughes. Several distinctive features enable the chamber to test the wide frequency range of the satellite's independent transponders in L-band, C-band, and UHF. The chamber's absorption materials vary from 26 to 48 inches in depth. It has seven antennas for measuring spacecraft systems and providing telemetry and command functions between spacecraft and systems test equipment. Three satellites are being built under contract with Comsat, the first scheduled for delivery next fall. They will provide communications for both the U.S. Navy and the maritime industry.

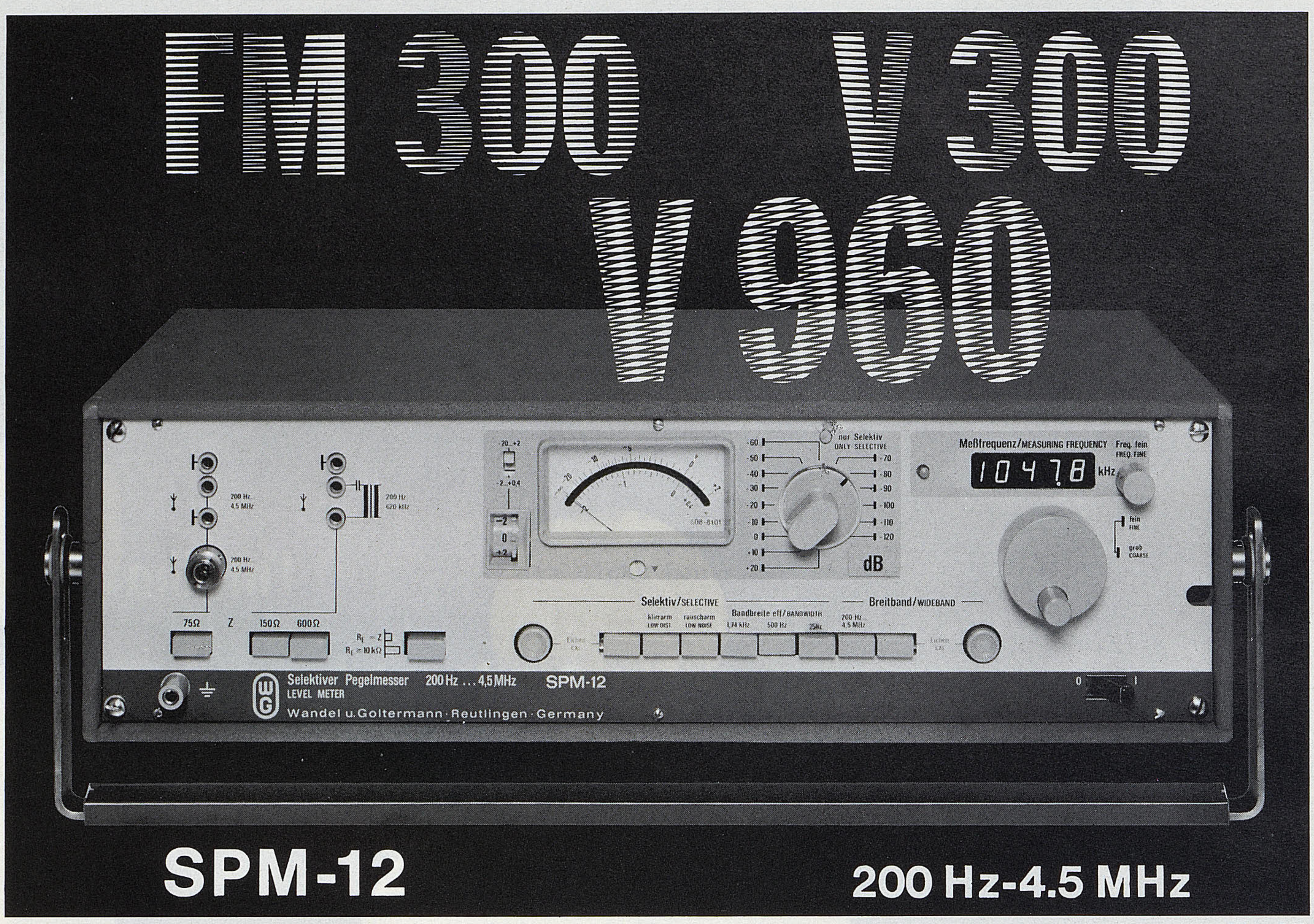
Day and night cloud-cover pictures of the entire earth are now being beamed twice a day directly to nations around the world by the NOAA-3 satellite, new primary weather watcher of the National Oceanic and Atmospheric Administration's worldwide environmental satellite system. This is made possible by the scanning radiometer built by Santa Barbara Research Center, a Hughes subsidiary. Pictures can be received in real time by 550 simple, inexpensive APT (Automatic Picture Transmission) stations located in 80 countries. NOAA-3 is 24th in the series of weather satellites launched since 1960.

Previously unknown faults and fractures in the earth's surface, detected in photos taken by the Hughes-built multispectral scanner aboard the Earth Resources Technology Satellite (ERTS), may help geologists discover new deposits of oil, gas, copper, lead, zinc, uranium, iron, gold, and silver, according to Dr. Nicholas Short, NASA geologist. ERTS travels in a 496-mile-high, near-polar orbit. The multispectral scanner images a swath 115 miles wide, covering the entire earth every 18 days. It has sent back more than 80,000 photos since ERTS was launched on July 23, 1972.

HUGHES

HUGHES INTERNATIONAL
HUGHES AIRCRAFT COMPANY
CULVER CITY, CALIFORNIA, U.S.A.


same capacity
I`m slim
I`m big
how possible?


FM 300
V 300
V 960
Selektiver Pegelmesser 200 Hz ... 4,5 MHz
SPM-12
LEVEL METER
Wandel u. Goltermann · Reutlingen · Germany
Meßfrequenz/MEASURING FREQUENCY
10478 kHz
dB
Selektiv/SELECTIVE
Bandbreite eff/BANDWIDTH
Breitband/WIDEBAND
SPM-12
200 Hz-4.5 MHz

EF 3112 K

Selective and Wideband Level Meter with positive assurance for future system expansion to 960 channels

This small, portable and handy equipment will become your universal level meter whether you work in development, test department or in system operations. Due to its wide range of frequencies, the Level Meter SPM-12 is suitable equally for measurements on lower frequency channels as for CF-systems up to V 960. It has many new technical features and provides you with an easy means for measuring:

✳ Input sensitivity, selective –120 dB/dBm
wideband –60 dB/dBm (at full scale deflection)
✳ High resolution of level readings;
expanded scale for 2 dB
✳ Switchable measuring ranges; steps of 10 dB
✳ Five decades, flicker-free, digital display switchable to 10 Hz resolution
✳ Balanced input
✳ Universal Versacon® 9 connectors for simple changeover to all usually available connectors
✳ High impedance test probe
✳ Effective noise bandwidths of 1.74 kHz or 500 Hz;
optional, 25 Hz

The Level Generator PS-12 and the SPM-12 combine into a complete level measuring set-up. Sweep Unit WZ-6 can be added for swept measurements.

Mesureur de niveau SPM-12 dont l'avenir est assuré par extension jusqu'à 960 voies

Cet appareil, petit et compact, veut être votre mesureur de niveau universel, pour travail en plate-forme, bureau d'étude ou contrôle en exploitation. Par sa gamme de fréquence étendue le SPM-12 peut être utilisé pour des mesures de canaux de basse fréquence, de systèmes à courants porteurs, y compris V 960. De nombreuses améliorations techniques simplifient vos mesures:

✳ Sensibilité d'entrée,sélective –120 dB/dBm,
large bande –60 dB/dBm (pleine déviation)
✳ Définition de niveau élevée par expanseur d'indication avec une échelle de 2 dB
✳ Gamme de mesure commutable par 10 dB
✳ Dispositif d'étalonnage semi automatique
✳ Affichage de la fréquence sans effet de défilement sur 5 décades, commutable sur définition 10 Hz
✳ Embase universelle Versacon® 9 permettant l'utilisation de toutes les fiches courantes
✳ Sonde active pour mesures à haute impédance
✳ Largeur de bande de bruit 1,74 kHz, 500 Hz,(25 Hz)

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PS-12
10478
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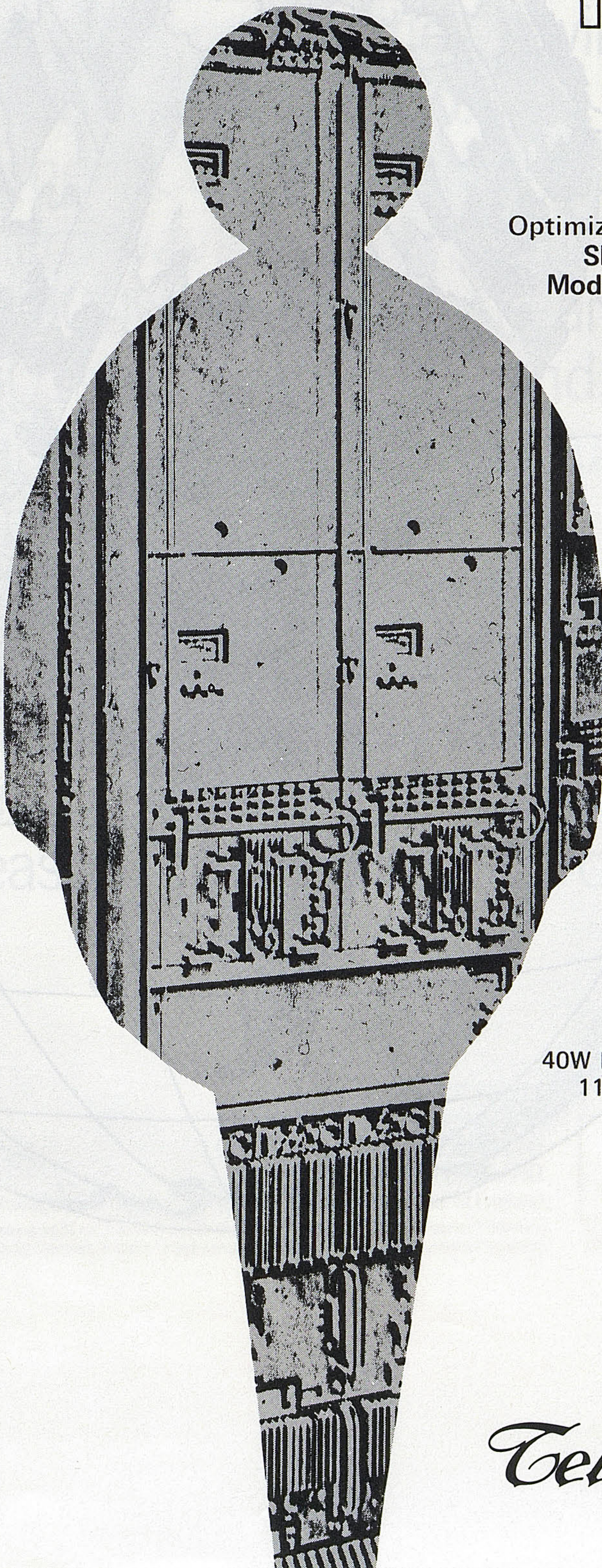
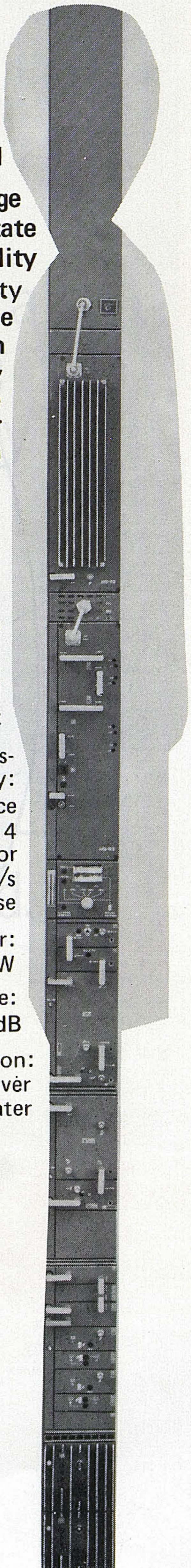
we both carry the same number of channels at microwave speed





HG-2

RADIO RELAY SYSTEM

2 GHz range
All solid-state
High reliability
Optimized maintainability
Slim rack structure
Modular construction
Great flexibility of use
Low power consumption
Easy and quick to install

General characteristics

Frequency band:
1.7 - 2.3 GHz and
2.5 - 2.7 GHz

Maximum transmission capacity:
300 - 960 voice channels or 1 TV+4 Sound channels or 34 Mbit/s PSK 4-phase

Transmitted power:
2.5 W

Noise figure:
5 dB

Power consumption:
40W high power transceivèr
11W low power repeater

Telettra

UPT-74/01

ON TOP OF THE WORLD
GEC ACROSS THE BOLIVIAN HIGH ANDES

An incredible undertaking – only possible with GEC's vast experience in world-wide communications.

A £3.25 million contract will bring Bolivian trunk telephone communications right up to date and provide facilities for TV to be relayed from Las Paz to other major cities. It will carry telex and data services, too.

Designed to meet CCIR recommendations, a broad band micro-wave radio system will cover a route length of 900km (560 miles) – and have a capacity of 960 telephone circuits and a standby protection channel which can also be used to carry television programmes.

Ten of the fifteen radio stations will be situated well over 3,600m (12,000 ft.) high with wide temperature and humidity variations. Such conditions require absolute dependability – a very good reason for choosing GEC of England.

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A Management Company of the General Electric Co. Ltd. of England.
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GB 5

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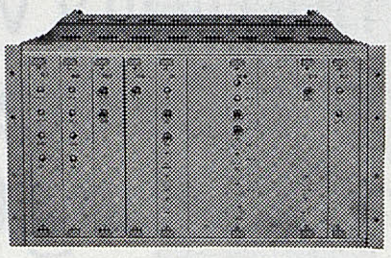
PCM TDMA promises you a better future with better communications.



4 PHASE PSK MODEM

Modulation: Coherent PSK • Bit Rate: $60 \sim 68$ Mbps • 1F: 70 MHz or 140 MHz • Bit Error Rate: 10^{-4} at E/No of 10.0 dB, 10^{-7} at E/No of 14.0 dB

• Acquisition Time of Carrier and Bit Timing: 800 nS • Mechanical configuration: Mountable on EIA standard 19" rack • Dimension: 19"Wx10.5"Hx18.5"D.

The amount of information to be communicated between countries is increasing at a rapid pace. Satellite communications systems are the most effective means for coping with the increase. Fujitsu, Japan's leading manufacturer of communications and electronics equipment, has developed the PCM TDMA (Pulse Code Modulation — Time Division Multiple Access) system after intensive research and technological development begun in 1967.

Fujitsu's PCM TDMA is the system that can replace the FDM FDMA system, more economically providing a larger number of satellite communications channels for earth stations than ever before possible. It also serves to set up either domestic or international networks depending on requests. The new PCM TDMA system integrates such advanced techniques as high speed PCM, Burst Synchronization over satellites, Digital Speech Interpolation, and PSK Modulation.

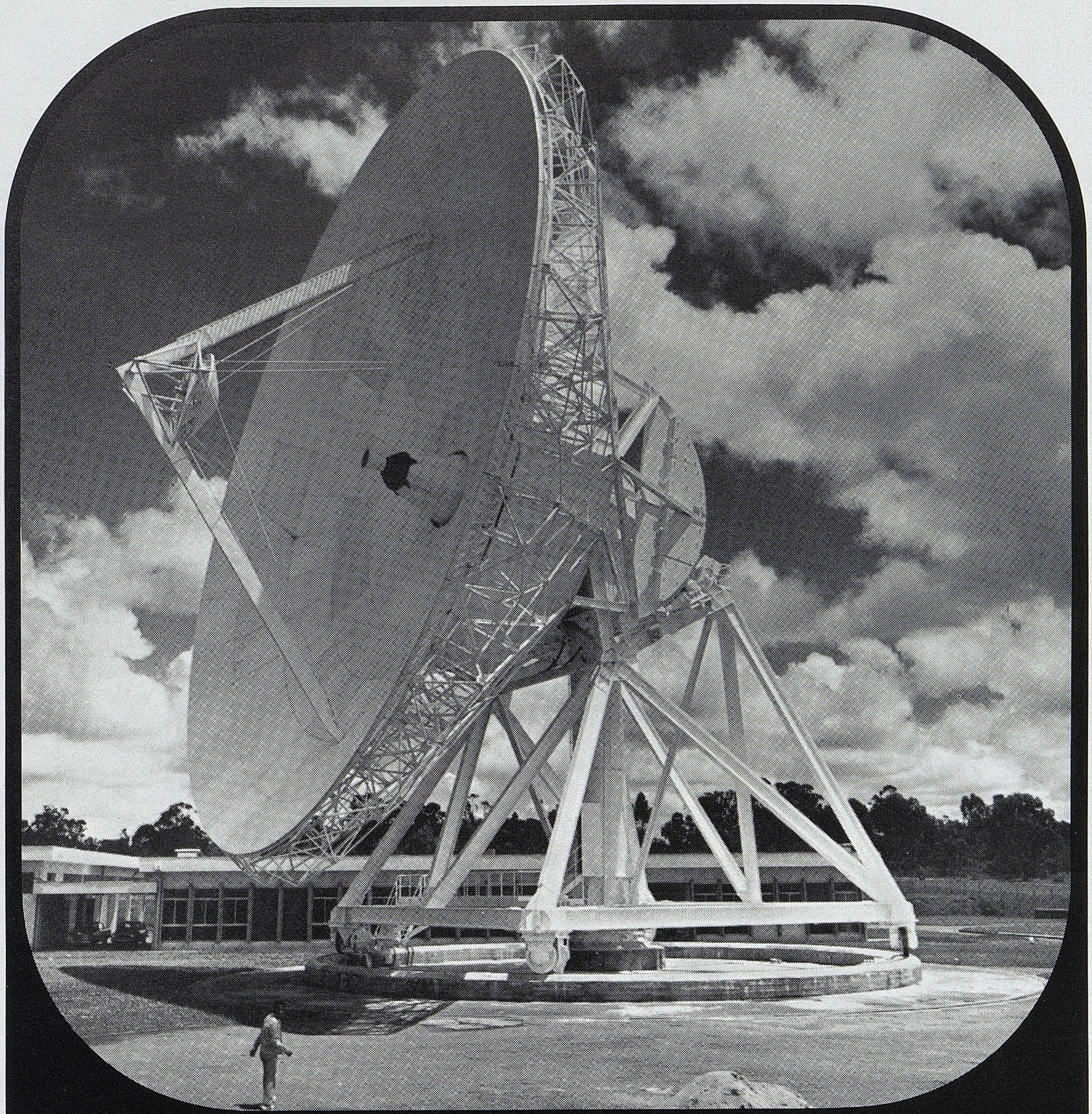
Among them, PSK MODEM is the key to the PCM TDMA system. It has been developed especially for the satellite communications systems using the INTELSAT IV-type satellite in conjunction with each phase of PCM TDMA's development; 4, 8, and 16-phase models of 30 $\sim$ 36 MBaud symbol rate were developed accordingly. It fully satisfies performance requirements for PCM TDMA, and is reliable and easily maintained.

Fujitsu. Experienced in high-performance satellite communications.

FUJITSU

FUJITSU LIMITED
Communications and Electronics
Marunouchi, Tokyo, Japan

MAIN PRODUCTS ☐ Telephone Exchange Equipment ☐ Carrier Transmission Equipment ☐ Radio Communication Equipment ☐ Space Electronics Systems ☐ Electronic Computers & Peripheral Equipment (FACOM) ☐ Telegraph & Data Communication Equipment ☐ Remote Control & Telemetering Equipment ☐ Electronic Components



Philibert Tsiranana Earth Station - Telspace Photo

Satellite
telecommunications antenna

Alsthom - Division Neyrpic
Suppliers to Telspace
have equipped the earth stations in :
Martinique – Ivory Coast
Senegal – Gaboon
Madagascar – Cameroon
and Pleumeur-Bodou

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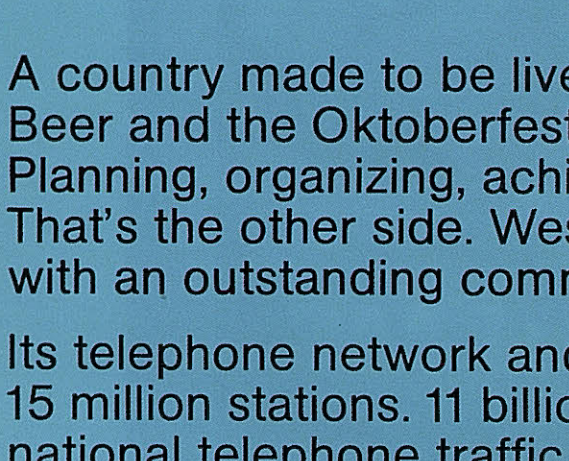
Its telephone network and telephone equipments are unsurpassed. 15 million stations. 11 billion calls annually. 100% automated national telephone traffic. 94% automated international traffic.

The Deutsche Bundespost switching system is composed entirely of EMD and ESK equipment. A total of 10 million line units.

A case in point – the Frankfurt International Exchange, hub of international telephone traffic in Europe. Every day, 64,000 calls are established with 70 countries throughout the world... automatically.

Siemens EMD and ESK systems have proved themselves in many countries around the globe.



Frankfurt International Exchange

We'd be pleased to answer any questions you might have about telephone and switching engineering.

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SIEMENS

N 12/7309.102

Who calls whom? When and how long? And what about costs?

We have the answers
to your questions!

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For other purposes, a detailed report on calls can also be supplied. Furthermore, anyone can be convinced that the exchanges or P.A.B.X.'s operate perfectly.

Our products: Type GEG: Individual unit for print-outs on a paper roll. Type TKG: Individual unit for print-outs on a paper sheet. Type ZGE: Multiple system for connection to several subscribers, with print-outs coded in punched tape form (compatible to Data Processing Systems).

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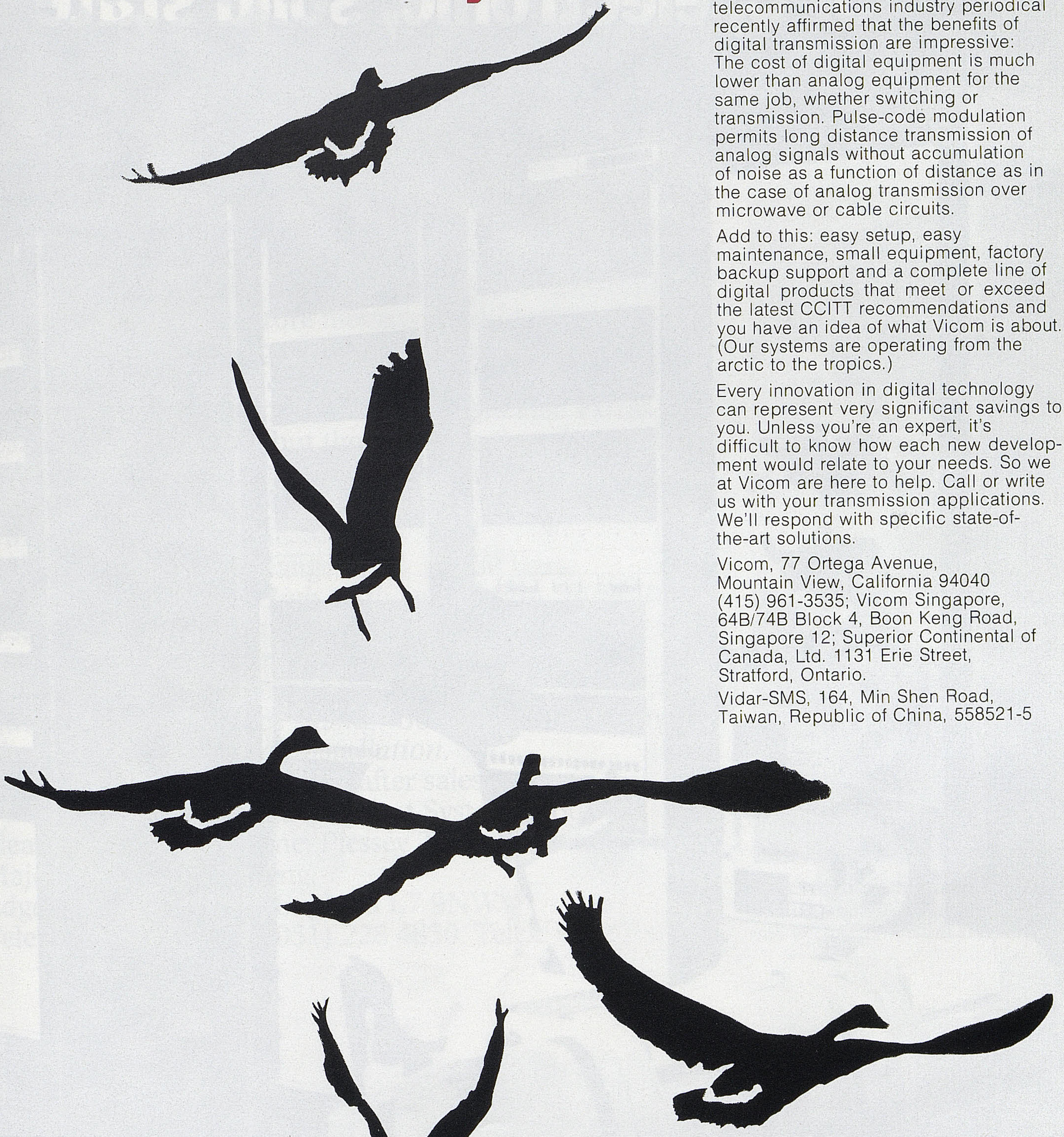

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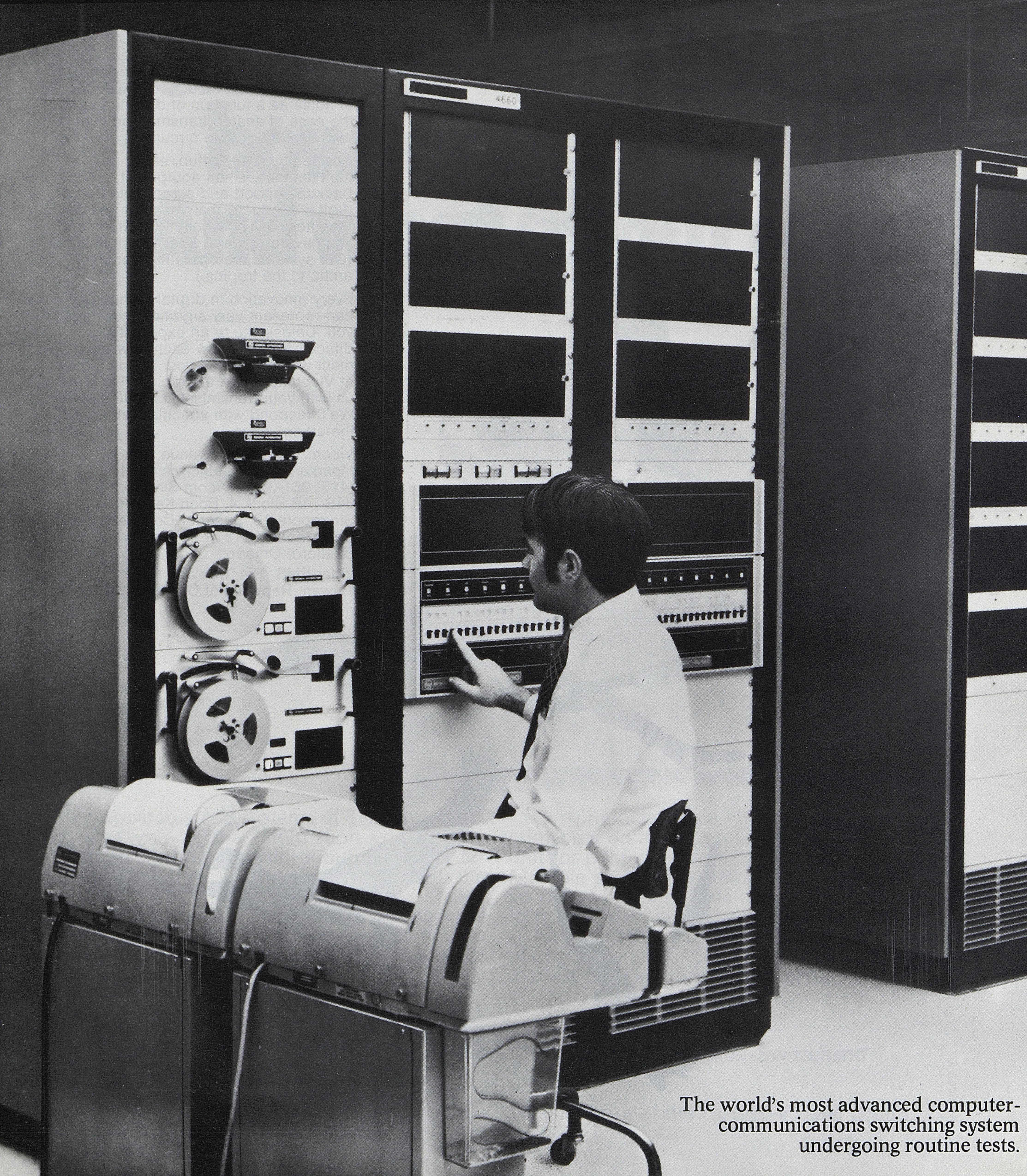

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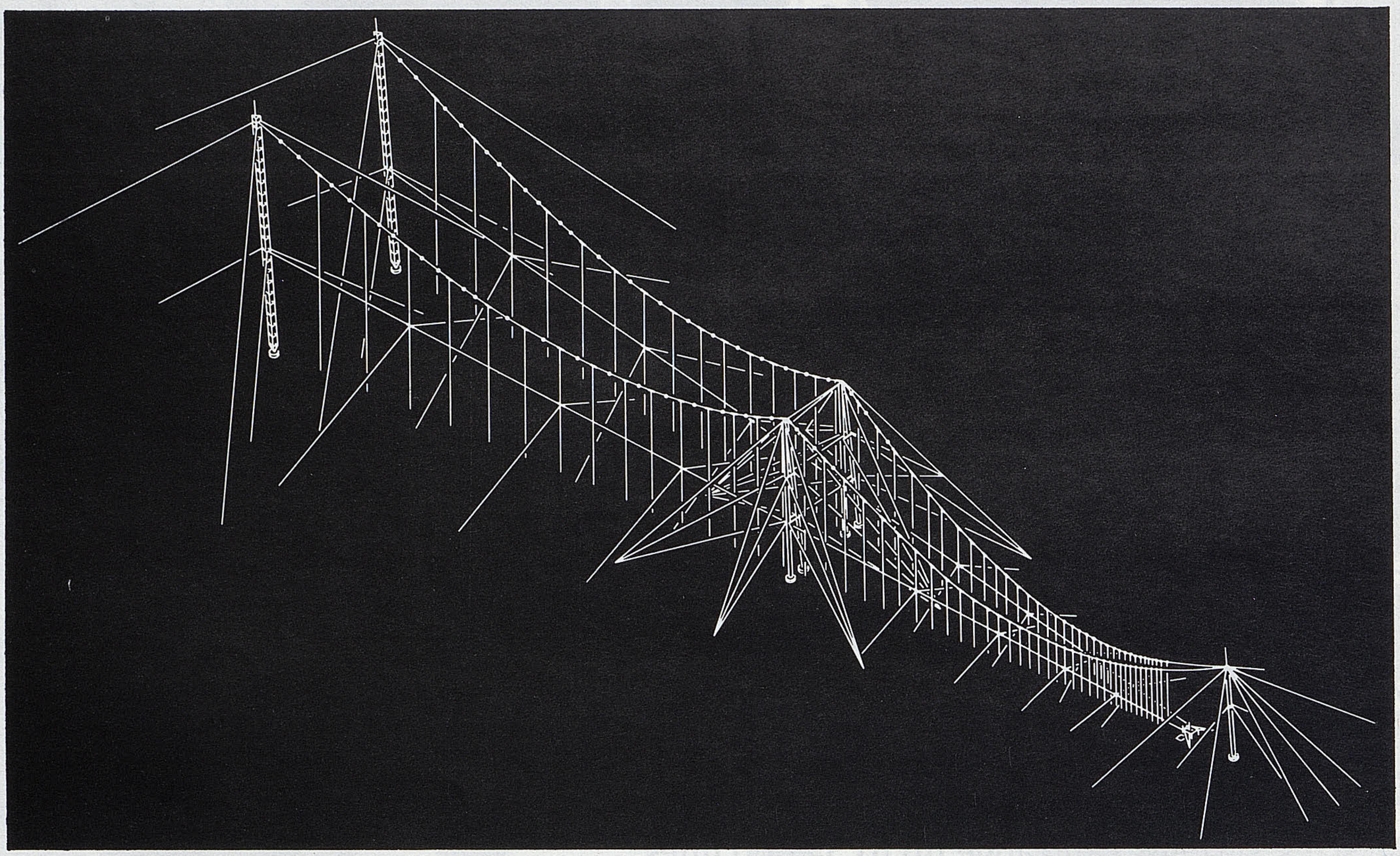

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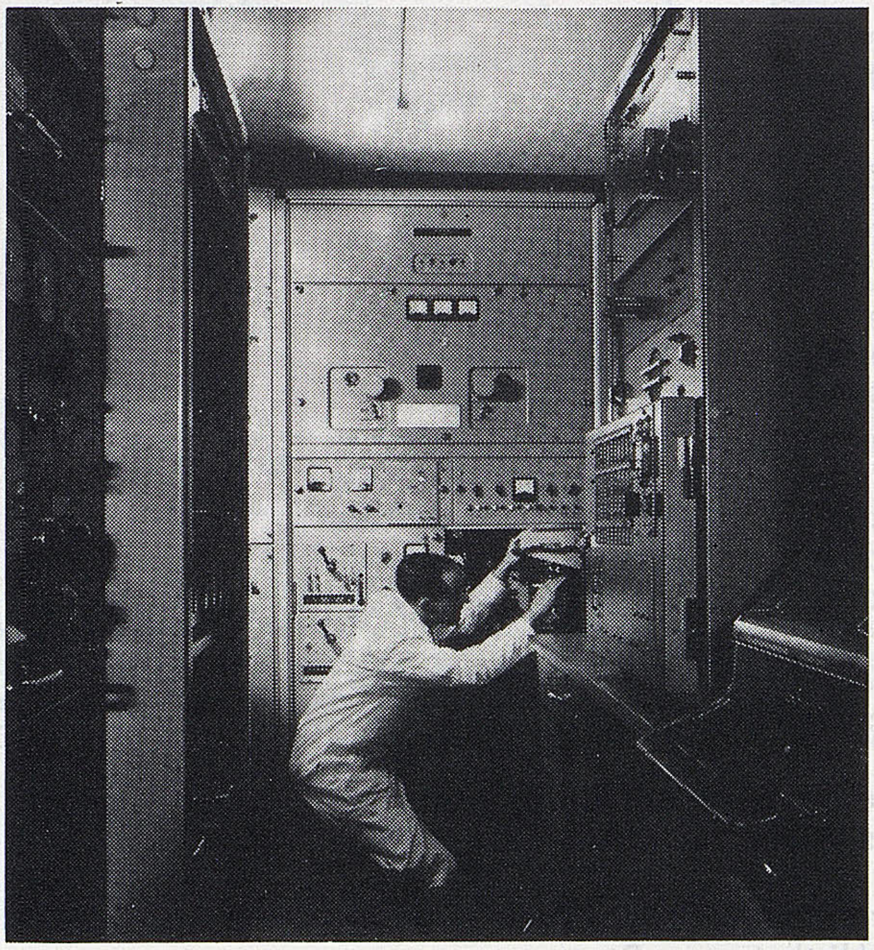

H 98

Marconi

PCM Systems

Marconi is the foremost manufacturer and exporter of PCM systems in the United Kingdom. More than 100,000 channel ends have been sold to the British Post Office, overseas telephone authorities and public utilities, because of technical quality, cost effectiveness and prompt delivery, coupled with highly experienced planning, installation and commissioning services.

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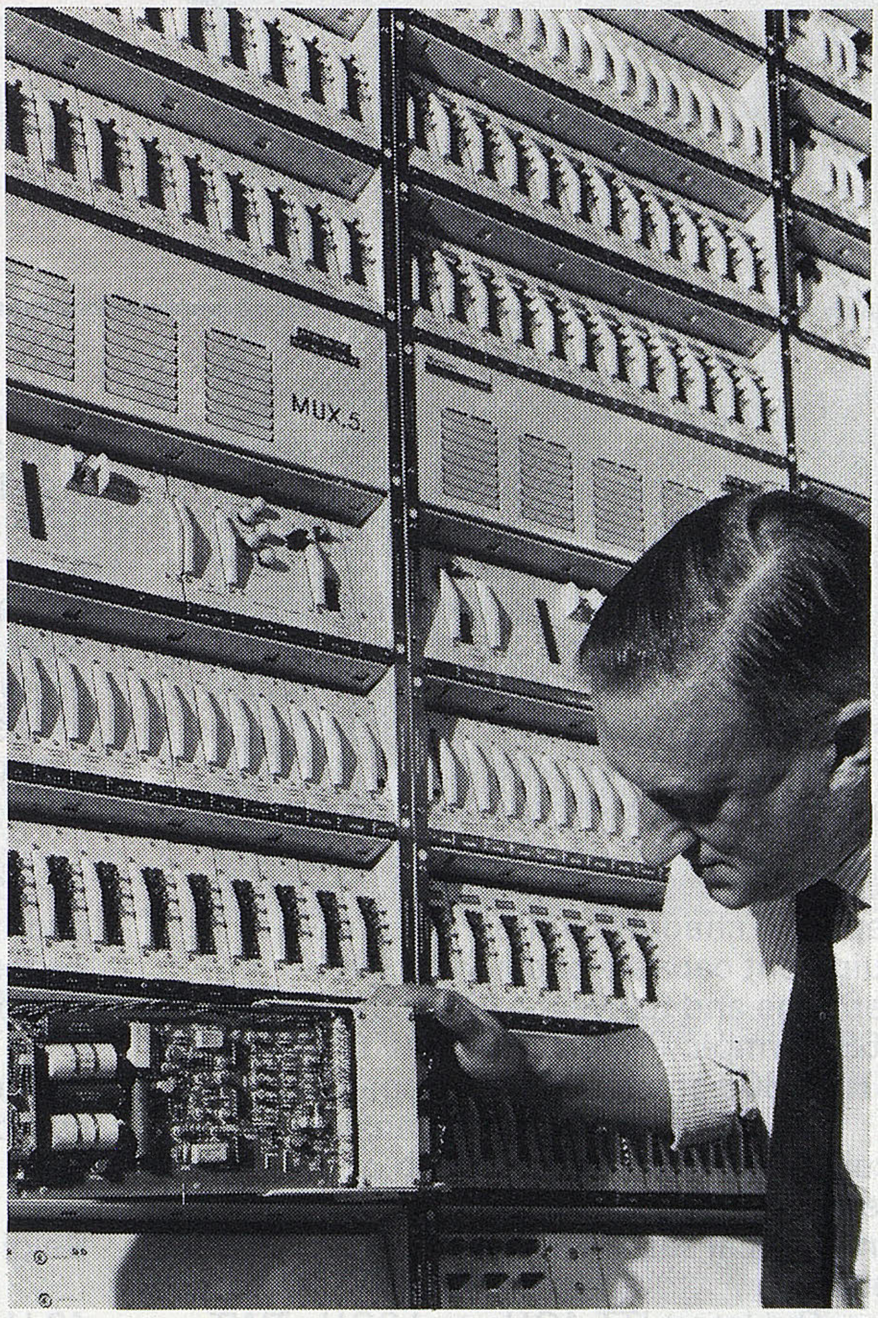

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Complete civil static and mobile communication systems

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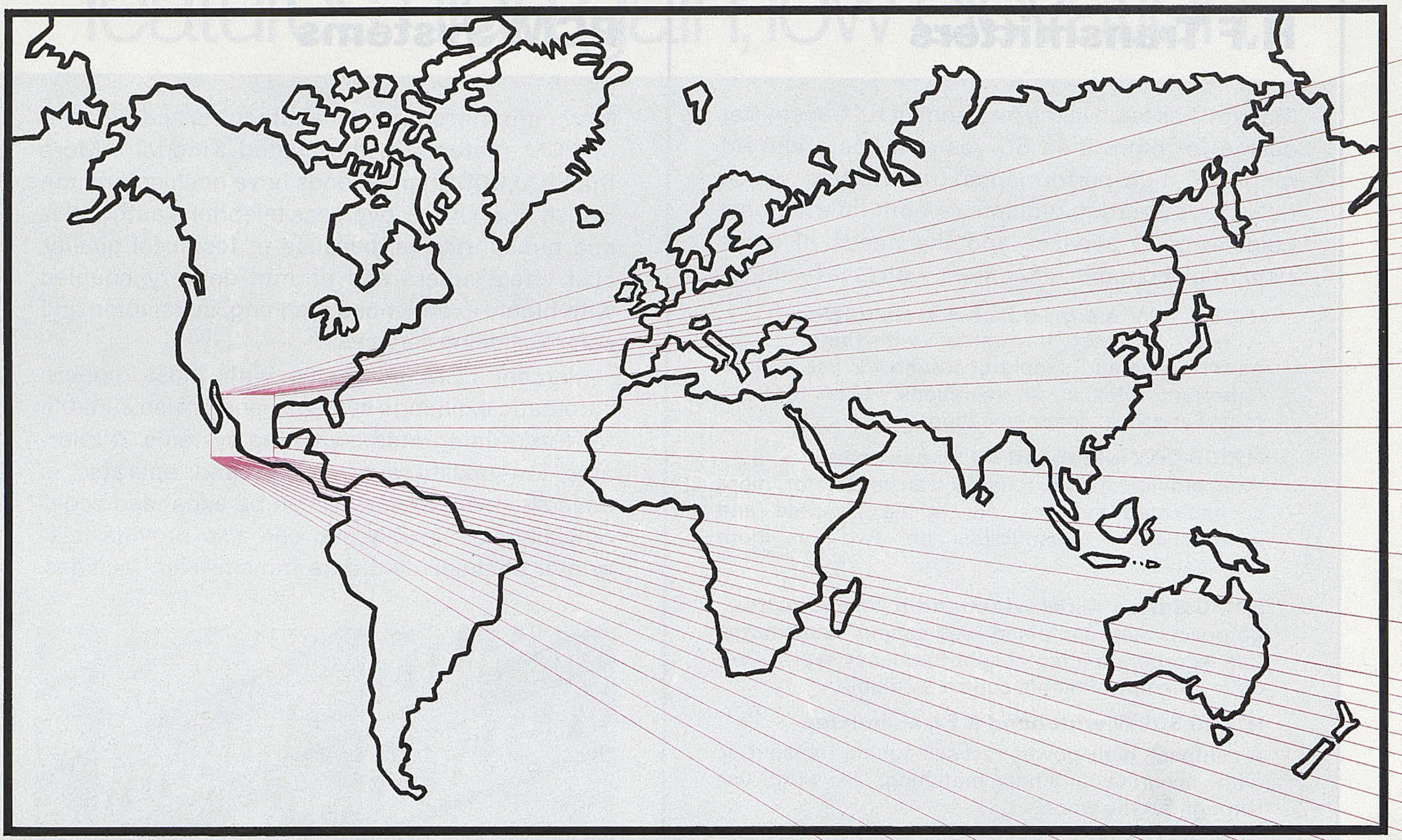
Plan for the world.



From ITT's family of companies in Europe come total land line transmission and cable systems – as well as microwave – to give you total capability from Voice Frequency to Voice Frequency.

For example, in the last fourteen years Standard Electrik Lorenz has been commissioned to supply and install radio link systems for more than a hundred stations for the Secretaría de Communicaciones de México and Teléfonos de México.

4GHz Systems were installed for 960 telephone channels, followed by 6GHz equipment capable of carrying 1800 telephone and television channels for the 1968 Olympic Games, and now the newest 4GHz–1800 channel/TV equipment.

More than a thousand transmitter receivers service a route length of 5000km, operating in climatic conditions ranging from tropical sea level to heights of 4,200 metres.

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The ITT microwave companies provide the experience, the problem-solving abilities and the equipment to get your worldwide systems working quickly, and completely reliably.

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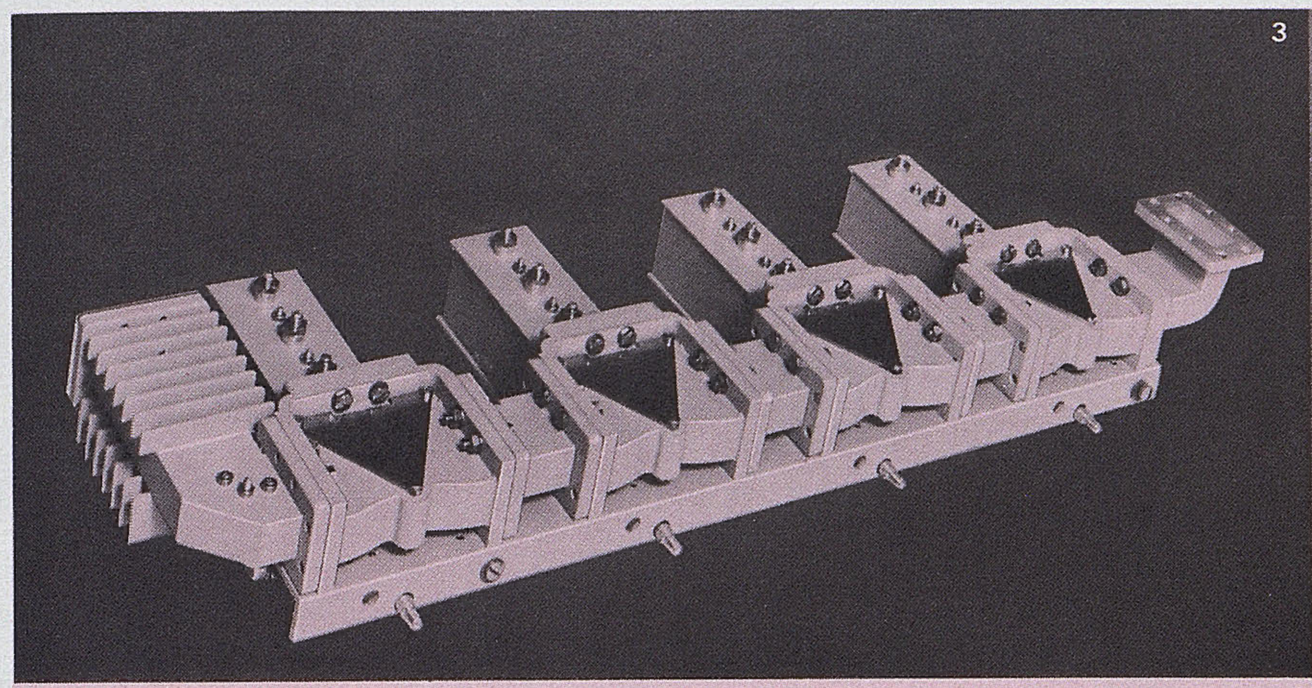
Standard Electrik Lorenz AG,
42 Hellmuth-Hirthstrasse, Stuttgart-
Zuffenhausen, Germany.

Plan for ITT Microwave Systems.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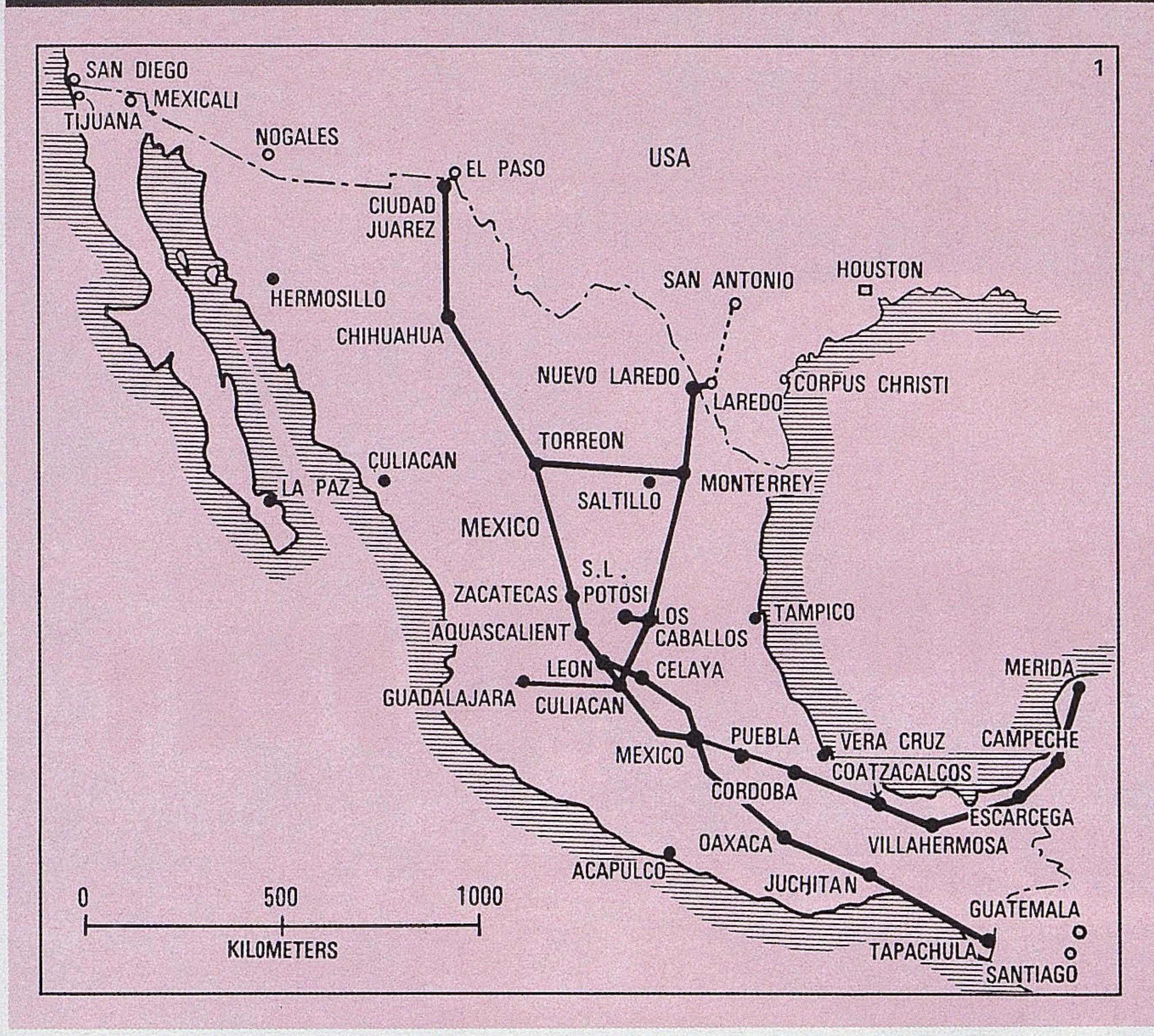
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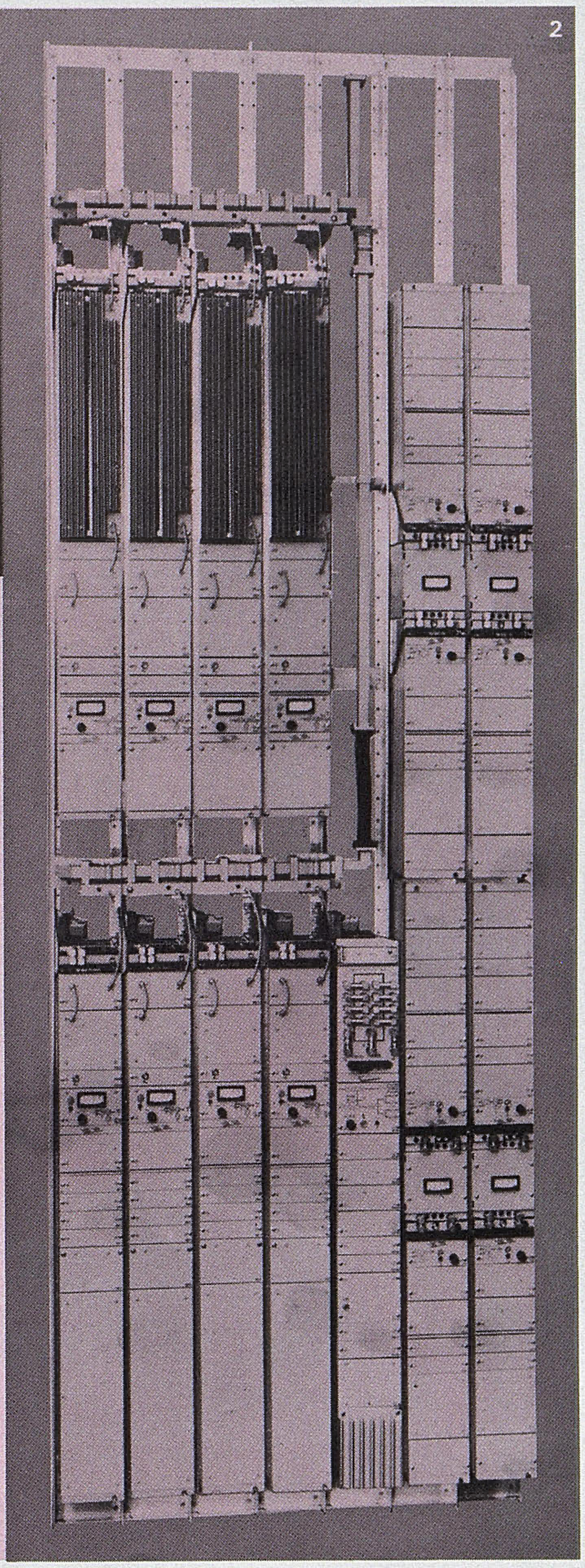
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1. Map of Mexico showing outline of radio networks installed by Standard Elektrik Lorenz.
2. 6 GHz equipment for 1800 telephone channels or television. The picture shows a terminal with 4 transmitters, receivers, service channel unit and 4 modulators/demodulators.
3. Compact 6 GHz RF channel branching filter for connecting 4 transmitters or 4 receivers to a common antenna.

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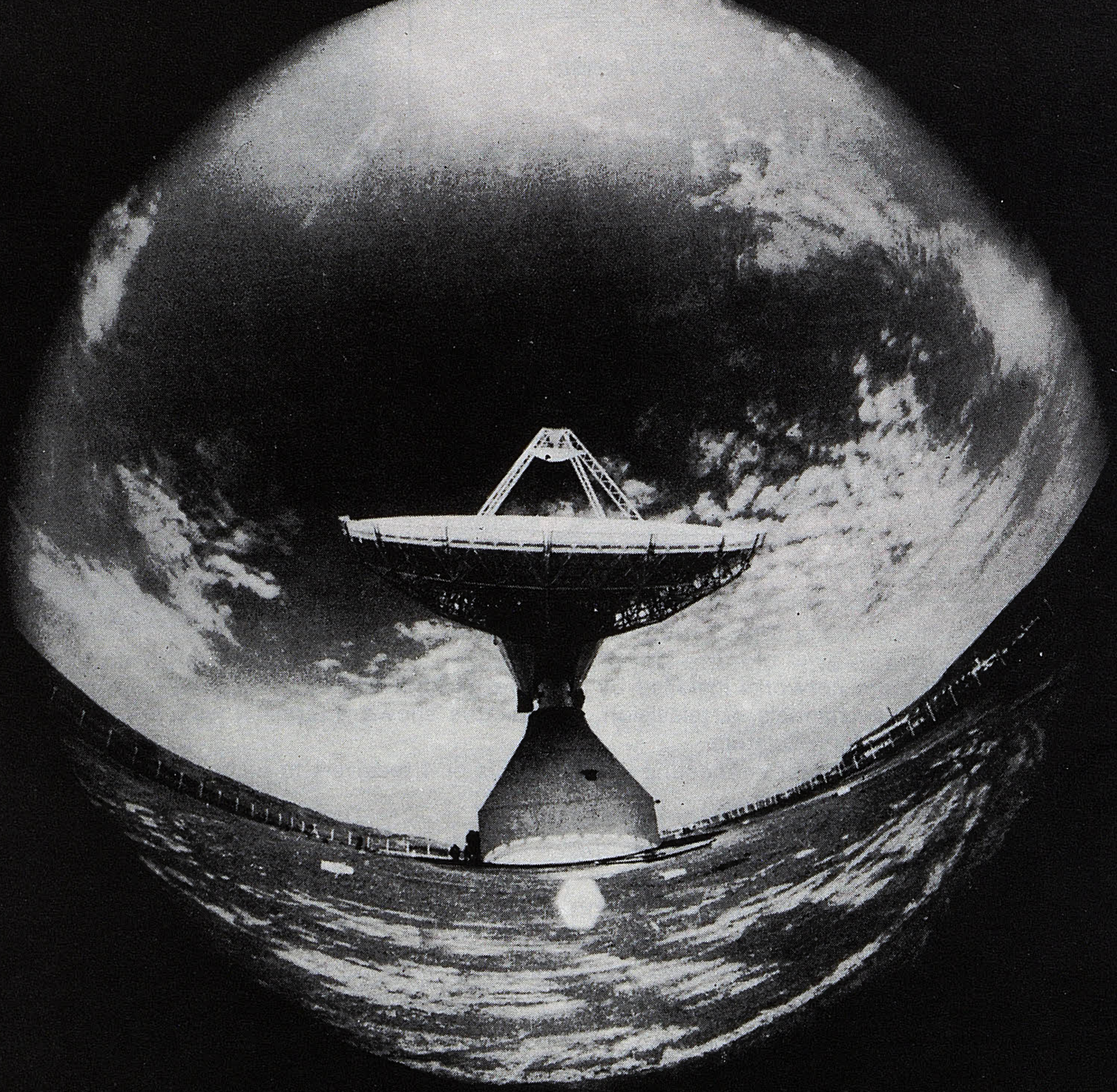

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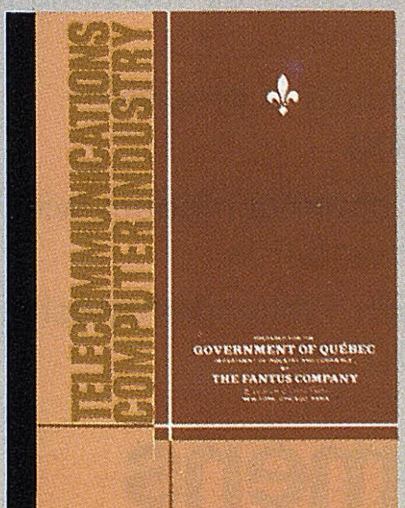

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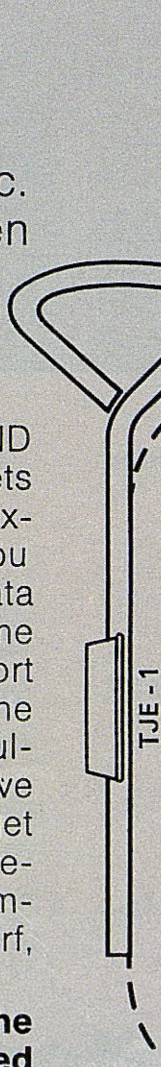

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company

address

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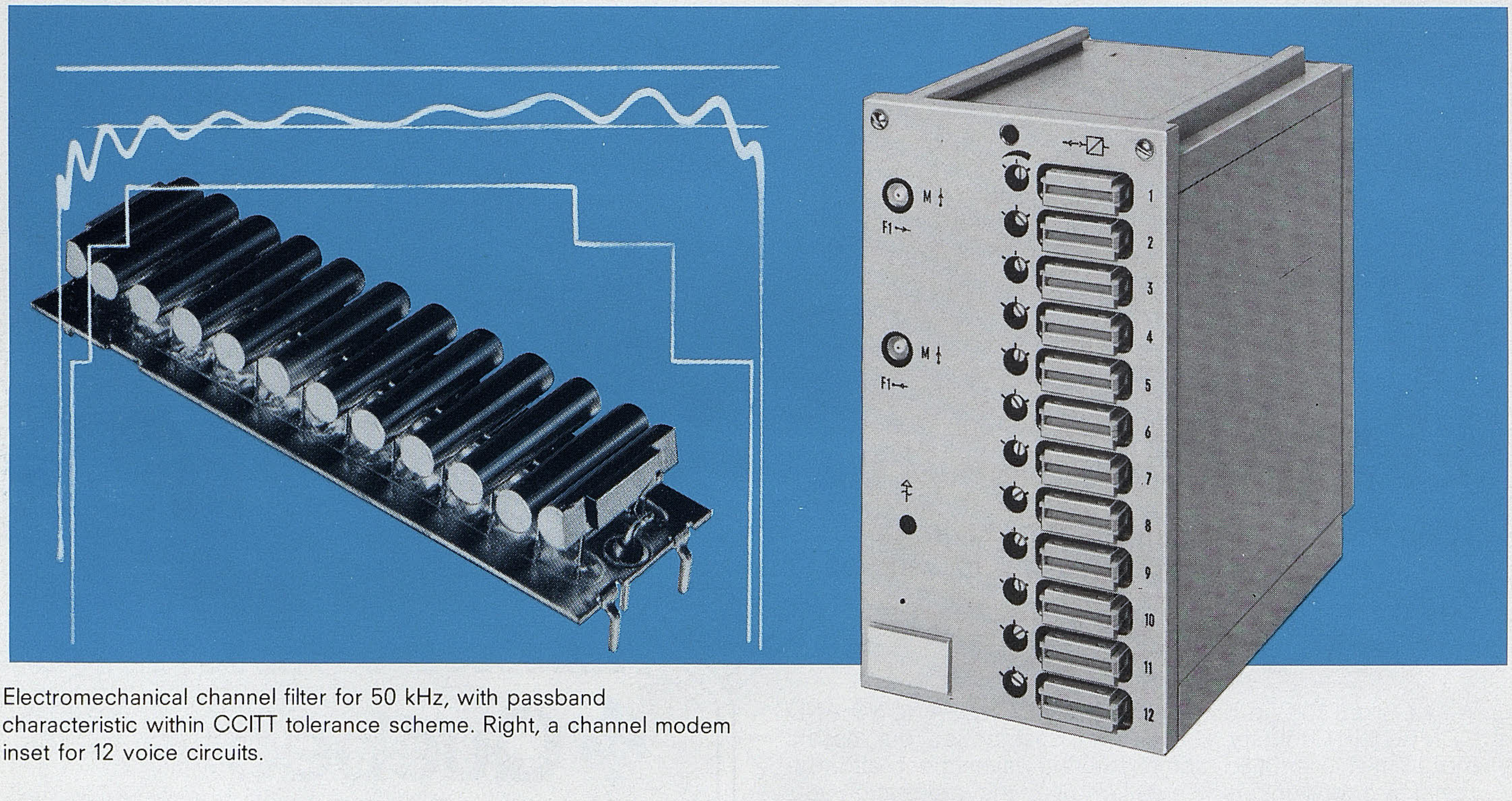
SIEMENS

New technologies set new standards. Example: the channel modem with electromechanical filters



Electromechanical channel filter for 50 kHz, with passband characteristic within CCITT tolerance scheme. Right, a channel modem inset for 12 voice circuits.

Principal characteristics:
Filters with mechanical resonators, with a Q-factor 30 times greater and a frequency stability 10 times greater than for LC filters. Attenuation distortion about 1/20th of CCITT tolerance scheme. One type of filter for all 12 voice circuits. Even higher reliability, thanks to thick-film hybrid circuitry and wrap methods. And not least, 1/5th the former space requirement. Channel modems for 600 voice channels can now be accommodated in the same rack space as previously required by modems for 120 voice channels.

Indispensable for the new high quality is precision manufacture with integrated testing.

In short, the Siemens-developed channel modem with mechanical filters is setting new standards.

Siemens Aktiengesellschaft, Bereich Weitverkehrstechnik,
D-8000 München 70, Postfach 70 00 79

N 271/7401.101

Communications systems from Siemens

telecommunication journal

VOLUME 41 - No. IV - APRIL 1974

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SUMMARY

Page

Editorial
- The Maritime Conference (Geneva, 1974) . . . 222

Union Activities . . . 224

Gifts (Canada, Indonesia, Japan) . . . 228

Conferences or meetings external to the ITU . . . 232

The Journal one hundred years ago . . . 235

Ideas and Achievements
- Guglielmo Marconi (1874-1937) . . . 236
- " Cantat-2 " . . . 240
- " Spector ": a telegraph error-correcting system . . . 243

Statistical analysis of demand for telecommunication services in Greece
- S.K. ATHANASSIOU . . . 244

From the transparent to the clock-controlled data network
- G. BERGMANN . . . 254

Cross-stranding of telephone cables
- S. NORBLAD . . . 261

News . . . 267

New Products . . . 272

ITU Film Library . . . 273

Basic indices for ionospheric propagation . . . 274

Review of Reviews . . . 275

Books . . . 276

Tenders (Senegal, Greece) . . . 277

Official Announcements . . . 278

ITU Publications . . . 279

Inscription for TELECOM 75 *(colour insert)*

Table of artificial satellites launched in 1973 *(insert)*

Cover:
Marconi (centre) with his two assistants Kemp (left) and Paget on their arrival in Newfoundland in 1901 to conduct the first transatlantic wireless tests. One of the kites used for raising their aerial can be seen in the background

(The Marconi Company Ltd.)

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Table of Artificial Satellites Launched

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Répertoire des satellites artificiels lancés

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Lanzamientos de satélites notificados

El Servicio de Biblioteca y Archivos de la Unión Internacional de Telecomunicaciones (UIT) ha escaneado la colección completa de *Lanzamientos de satélites notificados* (1967-1993). Las copias electrónicas están disponibles en la dirección siguiente:

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Editorial

The Maritime Conference

(Geneva, 1974)

When the use of radio waves for communication purposes was initially conceived, the very first application thought of was to connect ships at sea with land stations which, to have a maximum action range, were constructed along the coast. And indeed the first international Conference to regulate radio telegraphy, which was held in Berlin in 1906, only considered the organization of communications between ship stations and coast stations. Of course, the first transmitters both on land and ships occupied a bandwidth which would be quite intolerable at present and the receivers were not very selective, receiving signals over a wide band of frequencies. However, the miracle of being able to communicate with ships at sea was primary and the bandwidth occupied in the radio frequency spectrum was of little importance.

Gradually, after the First World War, as the radio spectrum then considered usable became more fully occupied, specific bands were allocated to the maritime services. As more and more use was made of radio telephony, these bands have become increasingly crowded and are reaching a point in many parts of the world where they are no longer sufficient to accommodate traffic demands. However, the radio frequency spectrum is a limited natural resource and extension of these bands is not readily feasible, primarily from the frequency allocation standpoint, and so it has become necessary to find some means of making better use of the available bands.

The CCIR studies the technical and operating questions relating specifically to radio communications. The results of these studies and the use of the latest technical advances have made it possible for administrations to extend the use of the limited number of frequencies available to meet their ever-increasing demands for communications, while at the same time limiting the spectrum space used to the minimum essential to provide the necessary services in a satisfactory manner. These studies have thus led to the use of more stable frequency control devices, transmitters which are intended to emit signals only over the bandwidth required for their communication purposes, receivers which have acceptance bandwidths not much wider than required to receive the transmitted frequency spectrum of the desired station and new modulation and coding systems.

The World Administrative Radio Conference (WARC) to deal with matters relating to the maritime mobile service in 1967 decided to introduce the single-sideband technique (SSB) in all HF maritime bands in order to gain additional communication channels. The process of conversion is now being carried out by many administrations, but the date fixed by the Conference, by which all ship and coast stations must use only this technique, is still very much in the future, namely 1982. Proposals have, however, been made for the forthcoming Conference to advance this date. Furthermore, another decision concerning the date agreed upon in 1967 will need to be reviewed. At the 1967 Conference it was decided that the radiotelephone channels in the VHF band (158-175 MHz) should be reduced from 50 kHz to 25 kHz. Here again it is felt by some administrations that the final date is too far in the future and that the conversion should be accelerated.

Based on a CCIR recommendation, and to meet the urgent requirement in the maritime mobile service, the 1967 Conference permitted the introduction of the sequential single-frequency code (SSFC) selective calling system. Reports from administrations who are using this system indicate satisfactory operation. However, one limiting characteristic of the system should be mentioned: its spectrum requirement, which uses the bandwidth of one radiotelephone channel. In 1967, the CCIR already began to study new selective calling systems for future operational requirements. At the moment of writing this editorial, CCIR Study Group 8 has completed its discussions on this subject. A draft recommendation and report on a variety of digital selective calling systems have been produced.

As regards on-board communications by means of small portable apparatus, the Conference will have at its disposal a report on the maximum power to be permitted and an indication of how many channels in the VHF and UHF bands are required.

A very important recent activity of the CCIR concerns the application of satellite techniques for the mobile services. The various technical and operational characteristics of mobile satellite communications are covered in these studies, the results of which will be available to the forthcoming WARC. Closest collaboration between the CCIR and two inter-governmental organizations, IMCO and ICAO, is maintained in an effort to define satellite systems.

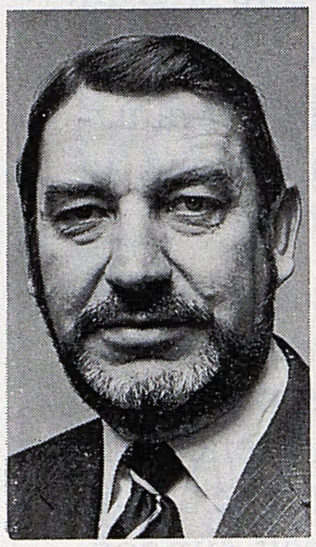
All other results of studies by the CCIR concerning the maritime mobile service and the maritime mobile satellite service will be made available to the conference as, for example, the use of Lincompex, the introduction of direct printing, self-supporting antennae on board ships, prevention of interference on board ships, facsimile, etc.

It is expected that the 1974 Maritime Conference will certainly bring about further improvements for the best possible use of the available radio frequency spectrum, based on the sound studies of the technical and operating factors relevant to this service being made in the CCIR.

J.W. HERBSTREIT

union activities

Visit by the Permanent Representative of the United States


Mr. F.L. Dale

Mr. Francis L. Dale, recently appointed Ambassador, Permanent Representative of the United States at the Office of the United Nations and the other international organizations in Geneva, paid a visit to Mr. M. Mili, Secretary-General of the Union, on 7 February 1974.

WARC for Maritime Mobile Telecommunications

The World Administrative Radio Conference (WARC) for Maritime Mobile Telecommunications opens at the Geneva International Conference Centre (CICG) in Geneva on Monday 22 April 1974.

The purpose of the seven-week Conference is:

— to consider and revise as necessary the provisions of the Radio Regulations and the Additional Radio Regulations for the maritime mobile and the maritime mobile-satellite services and for the radiodetermination and radiodetermination-satellite services used for maritime purposes, provided that frequency spectrum considerations be confined to those parts of the frequency spectrum already available for these services.

Subjects to be discussed by the conference may include:

1. The revision on the basis of single sideband operation of the Frequency Allotment Plan for HF radiotelephone coast stations covering the channels in the present Appendix 25 and the additional channels made available by the 1967 Maritime Conference.

2. The provisions for high-frequency radiotelephony.

3. The provisions concerning distress and safety in the maritime mobile service. In particular:

— the maintenance by certain ships of a distress watch on both 500 kHz and 2182 kHz;

— the possibility of an alternative to 2182 kHz as the radiotelephone, distress and calling frequency;

— the use of radioteleprinter and selective calling systems in relation to the safety service;

— the designation of common scene-of-action frequencies other than 500 kHz and 2182 kHz;

— the 1971 Space Conference's provisions with respect to frequencies for EPIRBs (emergency position-indicating radio beacons);

— distress operations involving manned spacecraft;

— the use of auto-alarm signals;

— silence periods;

— the use of portable devices on lifeboats and other survival craft;

— the use of radio direction-finding.

4. The VHF provisions generally, with particular reference to:

— Resolution No. Spa2-5 of the 1971 Space Conference with regard to the use of satellite systems for safety and distress on certain channels in the bands 157.3125-157.4125 MHz and 161.9125-162.0125 MHz;

— the use of VHF for facsimile and similar transmissions, other than radiotelephony;

— the use of selective calling on VHF;

— the use of VHF for communication between helicopters/light aircraft and ships;

— further reduction of channel spacing in the VHF bands allocated to the maritime mobile service (revision of Appendix 18);

— the use of frequencies for movements and safety communications.

5. The need for more specific provisions with regard to selective calling—in particular:

— amplification of procedures;

— the classes of emission to be used.

6. The introduction of facsimile in the MF bands.

7. The provisions relating to the use of frequencies for manual telegraphy in the HF bands with particular reference to:

— the possible abandonment of harmonic relationships between frequencies in the different bands;

— other technical and operational possibilities aimed at more effective frequency utilization;

— special calling frequencies (Article 29, Appendix 15).

8. Matters relating to the use of direct printing and the assignment of frequencies for this purpose in the maritime service—in particular:

— the possible use of direct printing telegraphy on MF and VHF as well as HF;

— the question of international agreement on a standard system.

9. Technical and operational questions relating to the use of Lincompex.

10. Problems relating to the maritime services operating in the bands between 1605 kHz and 3800 kHz including the future assignment of the single sideband channels derived from the present double sideband coast and ship station assignments—in particular:

— improved use, by geographical spacing, of pairs of single sideband assignments;

— inter-ship channels;

— international common frequencies for working

i) from coast radiotelephone stations to ships of other nationalities, and

ii) from ships to coast stations of other nationalities.

11. The basic technical characteristics of equipment for maritime terrestrial services—powers, frequency tolerances, spurious emissions.

12. The international assignment of frequencies for operational internal communication on board ships.

13. Operational, technical and frequency regulations for the maritime mobile-satellite and radiodetermination-satellite services.

14. Questions relating to the use of frequencies for radiodetermination.

15. Transmission of port radar images to ships.

16. Article 40 and the associated provisions of the Additional Radio Regulations.

17. The hours of watchkeeping on board ships, and the watchkeeping zones.

18. Radio operators' certificates.

19. Revision of Resolution No. Mar 2 of the 1967 Maritime Conference and of the " Manual for use by the maritime mobile service " to take into account revisions of the Radio Regulations and the proposed revisions of the Telegraph Regulations and the CCITT recommendations *(White Book)*.

20. The status of the plan for oceanography provided for in Resolution No. Mar 20.

Detailed reports on the results of the Conference will be published in the *Telecommunication Journal*.

Marconi centenary

By a happy coincidence the WARC for Maritime Mobile Telecommunications will be held at the time when the 100th anniversary of the birth of Guglielmo Marconi (25 April 1874), is being celebrated throughout the world.

During the Conference a short ceremony will be held on 25 April to pay tribute to one of the fathers of radio and of maritime communications.

An illustrated article on the life and work of this great pioneer appears on pages 236-240 of this issue.

Meeting of CCITT Study Group Special A

Mr V.N. Vaughan Jr.

The first meetings during this plenary period of Study Group Special A and its Working Parties were held in the new ITU tower building 7-16 January, 1974. The Study Group was instructed by the 1960 CCITT Plenary Assembly in New Delhi to study all aspects of data transmission. Subsequently, it has been one of the largest and most active Study Groups, reflecting the widespread interest in this rapidly developing field.

The lively interest in data transmission is a result of the so-called marriage between computers and communications. Sometimes this " marriage " has been called a common-law or illicit marriage and others say that divorce has already taken place. In any event, experts on data transmission (from the PTTs and recognized private operating agencies) and experts on data processing (from the International Organization for Standardization (ISO), the European Manufacturers Association (ECMA), computer manufacturers, etc.) continue to make good progress in Study Group Special A on solving their problems in designing, providing and operating their mutual customers' data systems.

The Study Group was honoured by the presence and participation throughout the opening session of the CCITT Director, Mr. R. Croze. Not only did he bring valuable guidance in this session but he also attended the whole of the concluding plenary sessions of the Study Group so that, in his words, he could be best informed about its work.

The major work of Study Group Special A was entrusted to three Working Parties, each having as its Chairman one of the three Vice-Chairmen of the Study Group. Mr. G. Dennery (France) is the Chairman of Working Party 1 which deals with modems for data signalling rates of 2400 and 4800 bit/s on the general switched telephone network and parallel data transmission systems for use on the general switched telephone network. Mr. H. Biehler (Fed. Rep. of Germany) is the Chairman of Working Party 2 which is studying modems for data signalling rates of 4800 and 9600 bit/s on telephone-type leased circuits, Mr. G. Allery (United Kingdom) is the Chairman of Working Party 3 which is studying wide band modems for use over (48 kHz) group and (240 kHz) super-group channels and full-duplex modems for use at data signalling rates between 300 bauds and 1200 bit/s over the general switched telephone network and over telephone-type leased lines.

Additionally a number of Rapporteurs were appointed (or reappointed) and several of these held important meetings with their correspondents during periods when the Working Parties were meeting. On many occasions there were four or five simultaneous meetings (not including drafting groups) which is one indication of the hard and dedicated work of the delegates.

Mr. A. Gatfield (Communications Satellite Corporation (COMSAT), United States) is the Rapporteur on error control systems for use over the general switched telephone network. Mr. J.M. Gauthier (*Centre national d'études des télécommunications* (CNET), France) is the Rapporteur on several aspects of data service maintenance methods, including loop-back arrangements. Mr. A. Séthy (ETVA, Austria) is the Rapporteur on comparative tests of modems for use over telephone-type circuits. Mr. R. Rowland (Marconi, United Kingdom) is the Rapporteur on the electrical and functional characteristics of interfaces. Mr. C.H. Carrouge (P & T, France) is the Rapporteur on use of the push-button telephone and other uses of these signalling frequencies in parallel-type (as contrasted with serial bit-by-bit) data transmission systems over the general switched telephone network. Mr. K. Maier (*Deutsche Bundespost)* is the Rapporteur on data transmission of medical data, such as EKGs, over the general switched telephone network. Messrs. S.C. MacPherson (Canada), F.J. Puig Quesada (*Compañía Telefónica Nacional de España* (CTNE), Spain), E. Guérin (France) and G.J. Willis (United Kingdom) are Rapporteurs on vocabulary/definitions.

One of the important results of the meeting was the unanimous approval of two new draft recommendations on interfaces to be processed by the accelerated procedures, by letter ballots sent to all CCITT members, hopefully to achieve two new provisional recommendations by mid-1974. Both of these draft recommendations define the electrical characteristics of an interface which is compatible with LSI (large scale integrated circuit) technology. One of the draft recommendations is for a balanced interface and the other is for the case where each circuit is operated unbalanced, i.e., utilizes a common ground return circuit. Further study is required to outline the areas of application of these new interfaces but many are relatively obvious and noncontroversial. Since the principle use of these interfaces is between the DCE (data communications equipment) and the DTE (data terminal equipment), it is natural that the study has been greatly assisted by the co-operation of ISO and ECMA.

Although Working Parties 1 and 2 each had excellent (but differing) proposals for new modems, both received promises of several new proposals that would be submitted in time to appear as White documents well before the next meeting of the Working Parties, which is tentatively scheduled for December 1974. In view of this, both decided to concentrate their efforts in this meeting on a definition of the parameters and guidelines which would be used to decide which of the (probably conflicting) proposals should be developed into a draft recommendation for approval (hopefully) by the 1976 CCITT Plenary Assembly. This was an arduous task, which was completed, and one which the delegates felt needed completion before attempting to reach agreement on one of the various proposals.

The work of Working Party 3 is rather closely related to the probable needs of:

1) Study Group VII (New networks for data transmission) for a 64 kbit/s bearer channel over analogue facilities,

2) Study Group XI (Telephone switching and signalling) for a 64 kbit/s channel for use with a common channel signalling system, and

3) several speeds from 48 to 56 kbit/s for leased line customer usage, in some cases via satellite.

The elements of a draft recommendation for a new wide band modem were prepared and questions were addressed to the other interested Study Groups as well as to the administrations and ISO. Working Party 3 also reached a tentative agreement that the existing V.21 modem could be operated at data signalling rates up to 300 bauds over the general switched telephone network. It is expected that tests during the next year will justify a modification of V.21 to increase the maximum data signalling rate from its currently specified value of 200 bauds. Working Party 3 also clarified the possibilities of full-duplex synchronous operation at data signalling rates between 600 and 1200 bit/s and addressed questions as to requirements to Study Group VII, the ISO and administrations.

The general feeling of the delegates was that the meeting had not only made some substantial progress, but also that a good foundation had been made for the difficult work which remains to be done. Principally, this is to choose from among divergent proposals for modems and to agree upon new draft recommendations for submission to the 1976 CCITT Plenary Assembly. As usual, there was wholehearted co-operation by, between, and among the various delegations. There were continual efforts to understand opposing views and seek compromise agreements. On behalf of all the delegates, the Chairman again wishes to congratulate and to thank the Secretariat for their fine support provided to the meeting.

V.N.V.Jr.

Meeting of CCITT Study Group VII

Mr V.C. MacDonald

1. Formed by decision of the Vth Plenary Assembly, CCITT (Geneva 1972), Study Group VII (New networks for data transmission) met for the first time from 17 to 25 January 1974 at Geneva.

Two hundred participants examined the new list of questions, under the chairmanship of Mr. V.C. MacDonald (Canada) assisted by Vice-Chairmen Messrs. N.R. Crane (Australia), H. Gabler (Fed. Rep. of Germany) and A. Serrure (Belgium). Following the principle introduced by the Vth Plenary Assembly and ratified at the Malaga-Torremolinos Plenipotentiary Conference (1973), each of the Vice-Chairmen is associated with significant sections of the study programme.

2. In welcoming members to the splendid conference room in the recently completed ITU tower, the Director of the CCITT, Mr. R. Croze, referred to some decisions of the last ITU Plenipotentiary Conference. In particular, the VIth Plenary Assembly will have to meet no later than June 1976. Recalling that the Vth Plenary had instructed Study Group Chairmen to publish their final reports for general examination well before the next Plenary, Study Group VII found that it had exactly 24 months remaining for replying to its questions and completing its draft recommendations.

In summary presentations of the 67 contributions submitted, it was noted that in many countries data network planning and implementation were rapidly proceeding. Consequently the texts of the assigned questions, which in many cases were rather brief, were carefully examined for clarification and identification of sub-points and priorities in the light of new knowledge.

3. Queries on points arising from the meeting of Study Group Special A (Data transmission) were presented by its Chairman, Mr. V.N. Vaughan (United States). Others were received from Study Groups III (General tariff principles: lease of telecommunication circuits) and XI (Telephone switching and signalling), which had also previously met. Study Group VII adopted the principle that in addition to suitable abstracts from its meeting report to be published in the series of the other Study Groups concerned, its Chairman should, with the help of designated Vice-Chairmen, prepare brief acknowledgements addressed to the Study Group Chairmen concerned, in order to assure co-ordination in view of the accelerated study schedule. It was expected that Study Groups Special D (Pulse code modulation) and X (Telegraph switching) and possibly Study Group IX (Telegraph transmission quality; specification of equipment and rules for the maintenance of telegraph channels), and others could also be interested in the results obtained by Study Group VII.

4. In addition to data circuit switching by means of electronic exchanges, operating and technical aspects of the packet mode were considered. Here a fixed network is established, data being put into packets each with the destination included. These are routed through the fixed network according to self-contained addresses by software programmes in mini-computers located at network junctions to control the flow of the packets. The International Federation for Information Processing (IFIP), an organization of computer scientists which has recently been recognized for participation in the work of the CCITT, contributed to this study, which is of interest to certain countries preparing to implement such networks. International operation in the packet mode at some future date can be foreseen in certain cases. Mr. H. Bothner-By (Norway) commenced this study as a Special Rapporteur.

5. The variety of the questions and the urgency of the schedule led to several other assignments of Group Chairmen and Rapporteurs. Mr. E.E. Daniels (United Kingdom Post Office), Vice-Chairman of Study Group X, began establishing the requirements for signalling in circuit-switched data networks. Both common channel and channel-associated techniques are expected to be used, the latter being scheduled for implementation on synchronous networks by certain countries as early as 1976. This will be the subject of continuing work by Mr. Daniels. Mr. G. Rassmuson (Sweden) will proceed with common channel signalling for data networks in which both Study Groups XI and Special D are much interested. Mr. M.E. Brenton (United Kingdom Post Office) has the question points on the interface between users' data terminal equipments and the new data networks, a subject of particular concern to the International Organization for Standardization (ISO). Mr. C.K. Hunter (ISO) agreed to examine the analysis of alternative methods of character alignment at the user interface, which seriously affects the construction of subscriber terminals. This point being of equal concern to network designers, Mr. M. Davancens (France) will study character alignment rationalization in the hope of arriving at a uniform technique. Features available at the user's interface with the data network for the isolation and identification of faults, which may occur on either side, will be the subject of an *Ad Hoc* Working Party, the Chairman to be provided from Sweden.

Another aspect of concern to users is the security of data network services, for example for financial institutions, particularly the banking industry. Mr. D.C. Strahlendorf (Canada) will deal with this as a Special Rapporteur. The terminology used in Study Group VII contributions and reports is not always as yet well defined. The translation of many new terms is therefore difficult. A Rapporteur Group was established under Mr. R.N.E. Haughton (Canada), assisted by Messrs. E. Guérin (France), G. Alarcía (Spain) and G. Mitchell (United Kingdom Post Office), Mr. Guérin was also appointed, together with Mr. Crane, Vice-Chairman of Study Group VII, to advise, Working Party III/2, Chairman Mr. A.E. Schwamberger (United States), on points of operations and technology which may arise in their study of tariff principles for new data network services. This will be in support of the replies from Study Group VII to the questions already put by Study Group III.

For international transmission of data services by circuit switching between synchronous national networks, each must maintain rythm such that data elements are not mutilated or lost in passing from one to the other. This timing problem has now begun to receive more detailed attention. It is also necessary, for the recovery of the intelligence in each multiplexed data channel, to recognize the framing information being carried in the bit stream. As the same basic envelope structure is not foreseen for every national data network, the specifications which have been recommended for interleaving at the international interface remain under very active study. Characteristics of the bearer channels operating at 64 kbit/s and their interfaces are also coming under closer examination.

The six recommendations in the new X series concerning international aspects of data networks, drafted by Joint Working Party NRD (New networks for data transmission) under the chairmanship of Mr. A. Ohlmer (Fed. Rep. of Germany), were available for study in the recently published *Green Book*, Vol. **VIII**. No change is proposed in the classes of data services recommended. However, the term " public data network " was found to require clarification, as neither the telegraphy definition nor the telephony version are fully descriptive of the services envisaged between data processing computer installations and other subscribers to international data services. As for the list of user facilities, interworking with the telex and telephone networks has not been fully defined, as the user requirements for such services are not yet agreed. However, the need for a numbering plan which could take these possibilities into account was recognized. The two recommendations affecting asynchronous data networks are expected to require some up-dating by the end of the period. However, the two dealing with synchronous networks are expected to be considerably amended and supplemented by a number of others if the work progresses to sufficient conclusions in the time available.

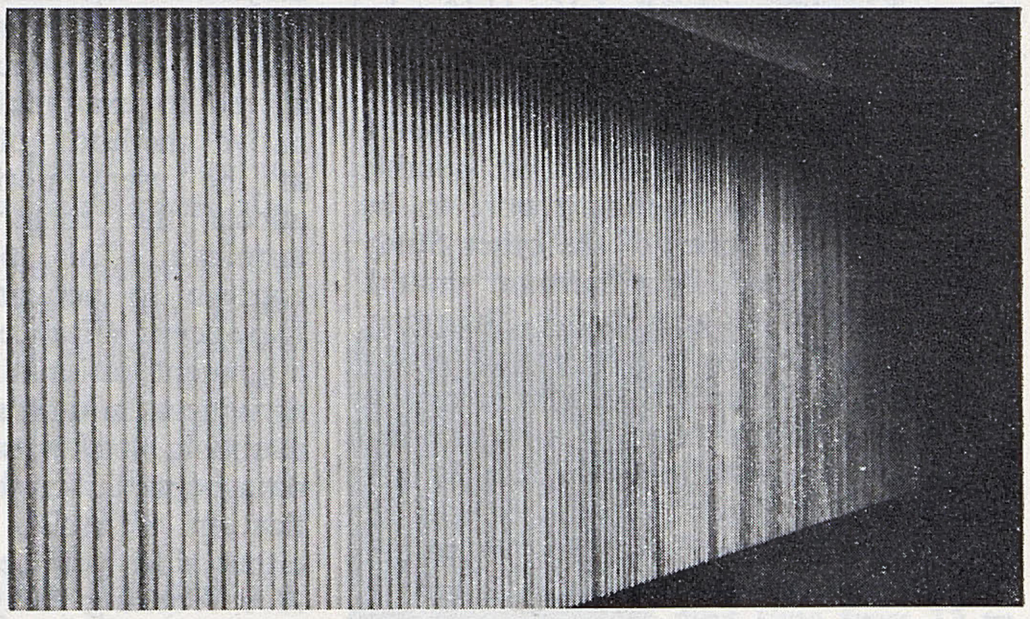
In preparing its meeting report the Study Group had before it the results of its Working Groups. The pressure of time made it necessary to proceed in some cases where translations had not yet been received, the texts having been hastily prepared by the members of the Working Groups themselves. In other cases the translated versions fell short of the accuracy necessary in debating the inter-related technical characteristics of new data networks. The spirit of co-operation was frequently called upon as most of the drafting had to be done in a single working language. However, the full report of the meeting, which will contain over 150 pages, will be distributed with minimum delay in the three working languages, with some further co-operation from the membership on the translation of new terminology.

Finally, a schedule of proposed future meetings was agreed by all members represented, as a guide for the preparation of contributions at least four months in advance, and as information which might be useful in the scheduling of the CCITT study programme.

V.C.MacD

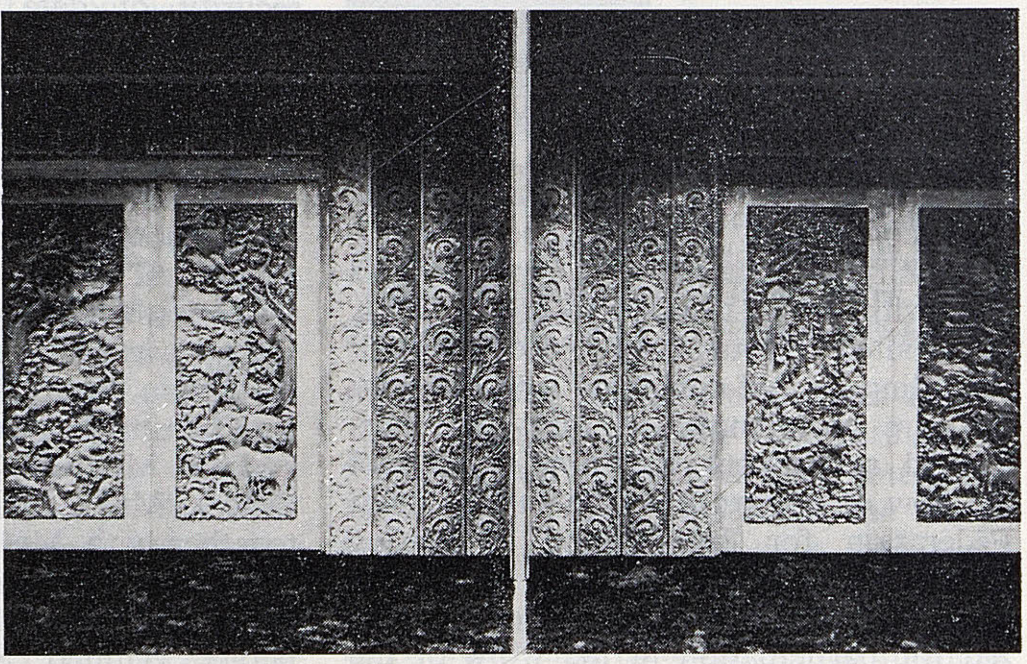
gifts

offered by Member countries of the Union for the ITU headquarters extension



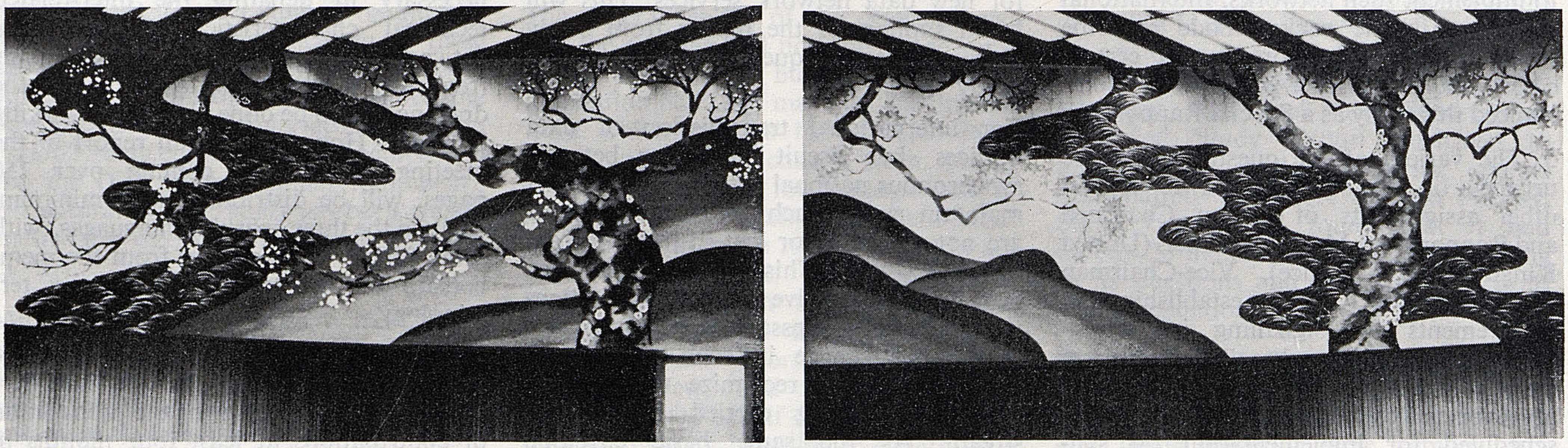
CANADA

Panelling for conference room



INDONESIA

Carved panels for conference room doors



JAPAN

Shiraume *Koyo*

Two tapestries 3×8m for main conference hall. The tapestries are patterned after two works by Ogata Korin (1658-1716), a representative painter of the Genroku period

technical co-operation

The Central American Telecommunications Institute

The Governments of the Central American countries, anxious to further the economic and social development of their peoples, which is hampered by the lack of communication facilities, have united to set up a modern telecommunications network which will interconnect countries in the region and link them to other countries throughout the world.

The first step towards this objective was to request assistance from the United Nations and in 1963 a mission of telecommunication experts made an evaluation of the national systems with a view to their planning and future development.

On 26 April 1966, in Managua, the Central American Governments acceded to a treaty whose purpose was the establishment of a modern telecommunications network in the region.

A Regional Technical Commission (known as COMTELCA) was immediately set up to ensure that the system would be modern and functional and provide rapid and reliable communications. The first (transmission) phase of the project has already been executed and to supplement it automatic exchanges are now being installed.

At the IVth ordinary meeting of COMTELCA, held in Guatemala City from 20 to 23 May 1968, representatives from each country declared that to ensure the satisfactory development of telecommunications the highest priority should be given to the setting up of a Central American telecommunications school to prepare adequate numbers of specialized personnel to work for the administrations in the area.

It was agreed that the school would be located at Santa Tecla in El Salvador and the necessary steps were taken to obtain technical and financial assistance from the United Nations Development Programme (UNDP) to build and finance the new centre, which would be known as the *Instituto Centroamericano de Telecomunicaciones* (INCATEL).

The proposal to create this study centre was also backed by recommendations from the Central American Bank for Economic Integration (BCIE) which is the source of COMTELCA's financing.

Certain difficulties occurring at this time did not stop preparations for the creation of the Institute but did cause some delay until January 1972, when Mr. José E. Cordero (Puerto Rico)—from the International Telecommunication Union (ITU)—arrived in the country as ITU-INCATEL Project Manager.

The curriculum is to be the following:

1. Basic course in telecommunications (two years).
2. Specialized courses in telecommunications (switching, transmission and external plant).
3. Telecommunication-oriented courses for the administrative staff.
4. Short courses and seminars on aspects of telecommunication for engineers.
5. Further training courses for staff already working in the administrations.

On 1 May 1972 two engineers entered INCATEL as counterparts to the Project Manager. Until 22 May of the same year INCATEL functioned in premises in the central offices of the *Administración Nacional de Telecomunicaciones* (ANTEL) in San Salvador but on the following day the Institute's offices were installed in Nueva San Salvador in a provisional building where three engineers and two secretaries were working. ANTEL began to provide the Institute with the furniture and equipment it needed, which was this Administration's contribution in return for the privilege of being host to the Institute. ANTEL had acquired a plot the size of about four and a half blocks for the Institute. In August 1972 the plans for the first building were completed and preparations for its construction were being made.

It was high time to begin as the telecommunication administrations needed specialized technical staff urgently. On 14 August 1972, 45 Central American secondary school-leavers began the basic telecommunications course—INCATEL was in action !

The Institute now had students, teachers and administrative staff. The classes were housed in the premises of the *Instituto Tecnológico Centroamericano* (ITCA), whose Director, Mr. Dennis Martin, provided lecture-rooms, laboratories, a library and other facilities and thus made it possible for INCATEL to begin its teaching activities in 1972.

According to Article 6 of INCATEL's statutes, the teaching and administrative policy of the Institute will be framed by a Board of Governors consisting of one Proprietary Member from each country, elected from the candidates presented by the telecommunication organizations of each Central American country associated in COMTELCA by a majority vote of the titular members of COMTELCA (the countries participating in INCATEL) with an Alternate for each of the Proprietary Members, elected in the same way.

The elections were held in Managua between 6 and 8 September 1972 during the XXIInd ordinary meeting of COMTELCA and the Board of Governors was composed as follows:

— for the Administration of Guatemala:
Col. José Maria Saravia García
Mr. Luis René Pellecer Solís

— for the Administration of El Salvador:
Mr. Hanns Bodewig Gallont
Mr. Roberto Ortíz Avalos

- for the Administration of Nicaragua:
  Mr. Iván Gaitán Domínguez
  Mr. Modesto Boves Barrios
- for the Administration of Costa Rica:
  Mr. Felipe Herrero Lara
  Mr. Nilo Vicarioli Corradi.

The Board of Governors of INCATEL was officially invested on 18 September and at its first meeting elected as Chairman Colonel José María Saravia García; as Vice-Chairman Mr. Iván Gaitán Domínguez, and as Director of INCATEL Mr. Armando Torres Mármol, who was a counterpart engineer during the pre-project phase.

By mid-1973, 10 of the 12 scheduled teachers, all engineers from Central America, were already in INCATEL, all of them very enthusiastic and fully conscious of the task entrusted to them. Their names are: Miguel Angel Ávila Flores, Ramón Silva Roa, Joaquín Rafael Barrios Miranda, Rodrigo Antonio Acuña Sáenz, Augusto César Gómez Romero, Abraham Rivera Obando, Rogelio Ulibarri Bilbao, Dionisio Ismael Machuca, Eladio E. Calderón and Manuel Andrade.

1.
At the inauguration ceremony of the new INCATEL building. From left to right: the President of ANTEL, Colonel Vicente Sánchez Hernández; the President of the Republic, Colonel Arturo Armando Molina; the Regional Representative ad interim of UNDP, Mr. Krishan G. Singh; the ITU-INCATEL Project Manager, Mr. José Cordero; Messrs. César de Tezanos Pinto and Hiroshi Waki

2.
The new INCATEL building, constructed at a cost of over 400 000 US dollars, was provided by the ANTEL of El Salvador to house all the Institute's services and dependencies

3.
The Institute possesses modern equipment for the practical teaching of telecommunication techniques; some of it was supplied by the UNDP

4.
About 100 students from Costa Rica, El Salvador, Guatemala and Nicaragua attend courses at INCATEL

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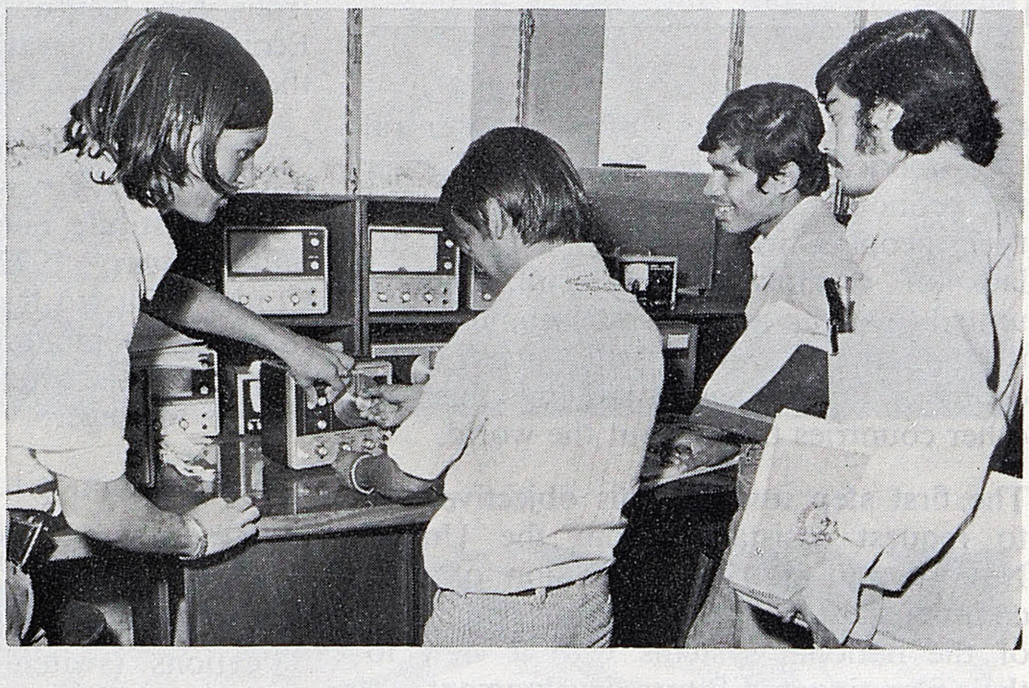

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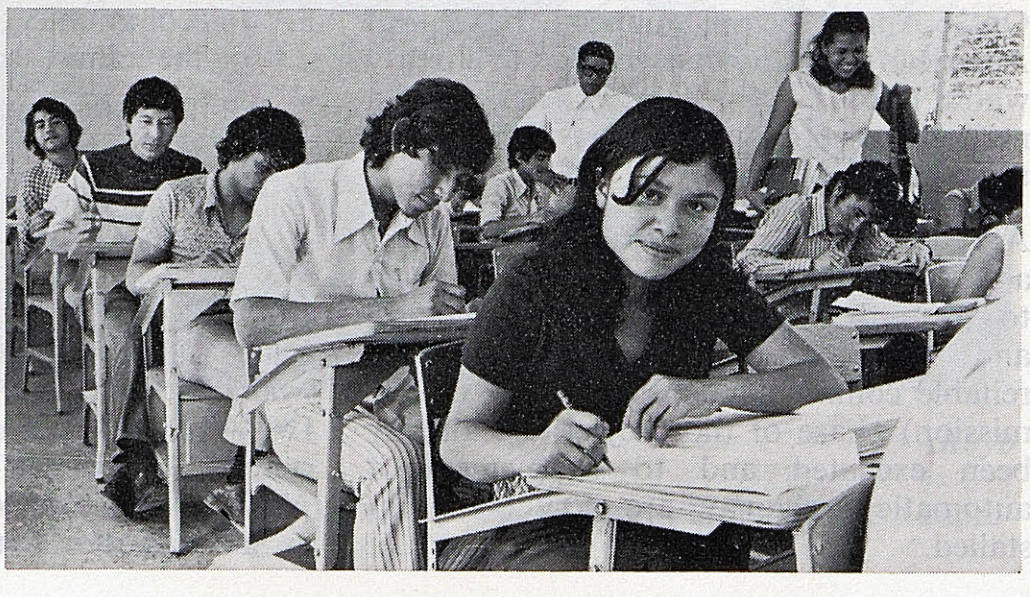

The following experts also arrived from the ITU: on 1 March, Mr. Carlos Ortega García (Colombia), telecommunications expert; on 1 June Mr. César de Tezanos Pinto (Argentina), switching expert, and on 28 September, Mr. Hiroshi Waki (Japan), transmission expert. Messrs. Hermann Argenstein Brink (Chile), expert in telegraph and telephone operation, and René Jean Buclin (Switzerland), expert in external plant, are due to arrive shortly.

The experts will remain about five years in INCATEL and their mission is to advise the instructors on their special subjects.

In August 1973 another intake of 100 Central American students began the basic course. This time INCATEL had the equipment for the electricity and electronics laboratory which enabled the students to carry out the basic experiments necessary for their studies and subsequent practical work.

All the arrangements have been made for the transfer to INCATEL of the transmission equipment which is now in the *Instituto Costarricense de Electricidad* (ICE) and which will be used for student training. The equipment belongs to the administrations participating in COMTELCA. The necessary action has also been taken to acquire switching equipment, which will be very complex, as the equipment installed and in operation in the administrations of the area is of many different types.

In the near future the Institute will also have a closed-circuit television system which is a very useful teaching medium for the type of instruction being given at INCATEL. Studies have already been made and the invitation to tender file prepared. The switching, electricity and electronics and closed-circuit television equipment are all part of INCATEL's contribution to the UNDP.

An important event for INCATEL was the appointment of the Centre's Deputy Director. At its tenth session the Board of Governors appointed Mr. Danilo Rodríguez Baltodano to the post, on the proposal of the ICE. Mr. Rodríguez has been working at INCATEL since early November 1972.

The Institute has three departments: teaching, student supervision and administration.

At the moment there are 97 students; in the next few years the student population will average 250. To meet these requirements, INCATEL will have 12 instructors, 10 technicians, 6 ITU experts and an administrative staff of about 25. The first group of students will graduate in July 1974.

The present Chairman of the Board of Governors is Mr. Iván Gaitán Domínguez, and the Vice-Chairman Mr. Felipe Herrero Lara. An important change in the INCATEL Board of Governors was the appointment of Mr. Luis René Pellecer Solís, Manager of the *Empresa Guatemalteca de Telecomunicaciones* (GUATEL) as Proprietary Governor and Colonel Jorge Héctor Cruz as Alternate.

The new building of INCATEL, completed and ready to house and serve generations of students who will be able to finish their studies and return to their respective administrations with a wealth of knowledge which they will use in the service of the peoples of the Central American countries, was inaugurated on 13 December 1973 by the President of the Republic, Colonel Arturo Armando Molina. — *United Nations Information Centre for Central America and Panama.*

Departures and returns from mission

name of expert	country of origin	speciality	country of assignment	period of contract and programme *	departure return
Allmark A.A.	United Kingdom	Power plant expert, national telecommunications development planning project	Lagos (Nigeria)	6.1.74-5.8.74 UNDP	departure
Botella A.L.	France	External telephone plant instructor at the Paraguayan Institute of Telecommunications	Asunción (Paraguay)	15.1.74-14.1.75 UNDP	departure
Ygland J.L.	Sweden	Expert in telecommunication traffic engineering at the Central Training School	Nairobi (Kenya)	21.1.74-20.1.75 UNDP	departure
Wuerst A.A.	Switzerland	Instructor in telephone installations	Bangui (Central African Republic)	18.4.68-21.8.73 UNDP	return
Berry D.W.	United Kingdom	Instructor in telecommunication training, Regional Training Unit	Kota Kinabalu Sabah (Malaysia)	1.2.71-31.1.74 UNDP	return
Cali G.	Italy	Instructor in transmission techniques at the Paraguayan Institute of Telecommunications	Asunción (Paraguay)	5.7.71-4.1.74 UNDP	return
Ievers F.G.E.	United Kingdom	Co-ordinator and expert in telecommunication organization and management	Djakarta (Indonesia)	29.4.73-28.1.74 UNDP	return

* UNDP = United Nations Development Programme.

Seminar on the planning of broadcasting systems in Africa

A Seminar on the planning of broadcasting systems in Africa was held at the Kenyatta Conference Centre, Nairobi, from 3 to 14 December 1973. The seminar was organized by the ITU and financed by the United Nations Development Programme (UNDP). Thirty-nine high-level officials from the broadcasting or telecommunication authorities of 24 African countries participated in the seminar.

The seminar was opened by the Minister of Information and Broadcasting of Kenya, Mr. Robert Matano. In his address, the Minister stated that radio broadcasting has a particularly strategic role in the social and economic development process in the less developed nations. As such, the use of the radio frequency spectrum is very important, in particular for those living in the continent of Africa. "It is therefore necessary, the Minister continued, that we develop in Africa a system that allows the use of the radio frequency spectrum with minimum mutual interference and maximum contribution of its use for development."

Participants at the Nairobi seminar

Mr. Karl Englund, Resident Representative of the UNDP in Kenya, spoke at the inaugural ceremony, on behalf of the Secretary-General of the ITU.

Lectures were given by specialists from Australia, Canada, France, the Federal Republic of Germany, Italy, Sweden and the United Kingdom, the cost of their participation being borne by their administrations. In addition, ITU staff members from the specialized secretariats of the CCIR and the IFRB presented papers.

The international broadcasting organizations such as the Union of National Radio and Television Organizations of Africa (URTNA), the European Broadcasting Union (EBU) and the Arab States Broadcasting Union (ASBU) also co-operated in the preparatory work for the seminar and in sending lecturers.

A very wide range of problems was discussed, embracing economic and social considerations, questions of manpower development and the technical options to be considered in relation to the rapidly developing broadcasting art. Although the seminar was principally concerned with LF and MF broadcasting, broadcasting in the HF and VHF bands was also discussed, as well as the fascinating possibilities offered by direct broadcasting from satellites, which is currently the subject of intensive study.

conferences or meetings external to the ITU

INTELSAT Assembly of Parties concludes first meeting

The first meeting of the International Telecommunications Satellite Organization (INTELSAT) Assembly of Parties was held in Washington, DC, from 4 to 8 February 1974.

Seventy-two of the 84 governments which are Parties to the inter-governmental Agreement of INTELSAT were represented at the meeting.

The Assembly of Parties accepted the invitation of the Government of Kenya to hold its second ordinary meeting in Nairobi, beginning 27 September 1976.

Under the INTELSAT Definitive Agreements (see *Telecommunication Journal*, March 1973), the structure of the organization consists of an Assembly of Parties (governments that are Party to the intergovernmental Agreement), the Meeting of Signatories (telecommunications entities designated by the Parties), the Board of Governors and an executive organ responsible to the Board of Governors.

The Assembly of Parties elected Mr. Raymond J. Waldmann, the Representative of the United States, as its Chairman and Dr. Osama Anani, the Representative of Jordan, as Deputy Chairman. Elected as Vice-Chairmen were Ambassador Alejandro Orfila, the Representative of Argentina; Ambassador Adolfo Alessandrini, the Representative of Italy; Ambassador Leonard O. Kibinge, the Representative of Kenya; and Ambassador Motoo Ogiso, the Representative of Japan.

Mr. Santiago Astrain, Secretary General of INTELSAT, opened the meeting and served as temporary chairman until the election of officers. Dr. Joseph V. Charyk, Chairman of the Meeting of Signatories, and Mr. Ernst Eliasen, Chairman of the Board of Governors, also attended the Assembly's meeting.

Although some representatives expressed reservations as to the credentials of certain delegations, the Assembly adopted the report of its Credentials Committee which found all 72 delegations attending the meeting to be properly accredited. The reservations expressed were ordered to be included in the record of the Assembly's discussions.

During its first meeting, the Assembly reached a number of decisions on matters of importance to INTELSAT, *viz*:

a) The Assembly found that the proposed United States Geostationary Operational Environmental Satellite *(GOES)* system would cause no harmful interference with the INTELSAT system, because the two systems have no frequency bands in common. The Assembly also found that the GOES system is technically compatible with the use of the radio frequency spectrum and orbital space by the existing or planned INTELSAT satellites.

b) The Assembly found that the proposed United States maritime satellite system would cause no harmful interference with the INTELSAT system and that the provision and use of the proposed maritime satellites would not prejudice the establishment of direct telecommunication links through INTELSAT satellites among all the participants. Although the Assembly recognized that the economic impact on INTELSAT of the proposed United States maritime satellite system could not be precisely assessed in the absence of any firm plans as to how, when, and at what charge INTELSAT would itself provide a maritime satellite service, the Assembly nevertheless found that no significant economic harm to the INTELSAT system need be expected.

The Assembly's findings as to the United States maritime system were based upon the assumption that any significant extension of the system beyond 1979, or widening of its scope, would be the subject of new co-ordination with INTELSAT.

The Board of Governors was asked to make a further report on this subject to the Assembly's next ordinary meeting in 1976.

c) While agreeing with the Board of Governors that a request by the United Nations for free use of the INTELSAT satellites cannot be accepted, the Assembly expressed its view that the Board, with the assistance of the Secretary General, should work out an arrangement with the United Nations whereby INTELSAT would do its best to ensure priority access to INTELSAT satellite capacity, for periods normally not exceeding 90 days, during emergency peace-keeping and disaster relief efforts.

The Assembly asked the Board to report to its second ordinary meeting on the actions taken in this regard.

d) The Assembly authorized the Board of Governors to establish formal relations, through the Secretary General of INTELSAT, with the International Telecommunication Union (ITU), the International Civil Aviation Organization (ICAO) and the Inter-governmental Maritime Consultative Organization (IMCO). Any such agreement will be subject to ratification by the Assembly. The Assembly recognized, however, that the Board of Governors, through the Secretary General, may have working relations with international bodies.

e) The Assembly selected eleven individuals nominated by Parties to the Agreement to serve as members of a panel of legal experts from which presidents of arbitral tribunals shall be selected. These tribunals will be competent to decide any disputes which may be submitted to arbitration pursuant to the inter-governmental Agreement and the Operating Agreement of INTELSAT. Selected as members of the panel were the following legal experts:

Messrs. Andrés Aguilar M. (Venezuela)
Guiseppe Barile (Italy)
Maurice Edward Bathurst (United Kingdom)
Aldo Armando Cocca, Argentina
Franz Gamillscheg (Federal Republic of Germany)
C. W. Harders (Australia)
S. P. Jagota (India)
Robert H. Knight (United States)
Pierre A. Lalive (Switzerland)
Ya-Rugango Nkubito (Zaire)
Fujio Uchida (Japan)

The Assembly also selected an alternate for each panel member. — *INTELSAT*.

Space geodynamics

Summer school on space physics at Lannion

This year, the summer school on space physics which the *Centre national d'études spatiales* (CNES) of France has run every two years since 1966 will be held from 20 August to 13 September at the University of Rennes in the *Institut universitaire de technologie de Lannion* (Côtes-du-Nord).

The 1974 programme will be devoted to space geodynamics.

The summer school, which is intended for research workers, engineers or students of any nationality at *diplôme d'études approfondies* or M.Sc. level, will study the technical methods of space geodesy and their application to classical geodetic problems (geodesic lines, potential, geoid) and to the study of the earth as a deformable solid (wandering of the pole, tides, continental drift). The extension of these methods to the acquisition of similar information on the moon and the near planets (Venus and Mars) will also be examined.

The following series of lectures will be given:

- Theory of motion of artificial satellites—Academy of Sciences of the USSR.
- Space geodesy methods and techniques—G. Weiffenbach, Smithsonian Institute, Cambridge (United States).
- The connection between space geodesy and classical geodesy—H. Moritz, *Technische Hochschule*, Graz (Austria).
- Study of the earth-moon system by space methods—J.D. Mulholland, University of Texas, Austin (United States).
- Determination of the potential of the earth by space methods—G. Balmino, *Groupe de recherches de géodésie spatiale*, Brétigny-sur-Orge (France).
- Study of the earth as a deformable solid by space methods—K. Lambeck, *Institut de physique du globe*, University of Paris.
- Study of the internal constitution of the moon by space methods—S.K. Runcorn, University of Newcastle-upon-Tyne (United Kingdom).

There will be seminars and practical work in conjunction with these lectures.

The studies will be directed by Professor F. Cambou of the Paul Sabatier University of Toulouse; J. Hieblot, Head of the Ionospheric Research Group; A. Lebeau, CNES Assistant Director-General responsible for programmes and industrial policy, and J.C. Husson, Chief of the CNES Scientific Programme Division.

Instruction will be given in French and English. Simultaneous interpretation will not be provided and applicants will be expected to have a good knowledge of both languages and also to attend all lectures.

The number of students, both French and others, will be limited to 40. No registration fee is required and instruction is given free of charge.

A limited number of fellowships to cover whole or part of board and lodging expenses may be awarded on application. Candidates' families can also be accommodated at the Lannion Hall of Residence.

For further details, write to: "CNES, Département des affaires universitaires, 129, rue de l'Université, 75327 Paris Cédex 07". — *CNES.*

Advertise in the Telecommunication Journal!

The TELECOMMUNICATION JOURNAL is the monthly magazine of the International Telecommunication Union, the United Nations specialized agency for telecommunications. It appears once a month in separate English, French and Spanish editions. It is read by the senior officials and directors of all major organizations, both governmental and private, which operate telecommunication services, and it is a unique medium of publicity for the manufacturers of equipment used in the management and operation of such services.

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THE JOURNAL

One hundred years ago

Statistique comparative de 1872.

OBJETS DE LA STATISTIQUE.	Allemagne 1).			Autriche-Hongrie.		Belgique.	Danemark.	Espagne.	France.	Grande-Bretagne.			Italie.	Norvège.	Portugal.	Pays-Bas.		Russie.	Suède.	Suisse.
	Territoire télégraphique de l'Empire allemand.	Bavière.	Wurtemberg.	Autriche.	Hongrie.					Office métropolitain 1).	Office Indo-Européen.	Office Indien.				Office métropolitain.	Office des Indes néerlandaises.			
I. Réseau.																				
a. Longueur des lignes du réseau entier en kilomètres	28,485.38	6,864.5	2,221.5	19,345.6	12,550	4,602	2,466	11,754	47,551	38,512.8 2)	5,449 1)	25,110	19,495	6,470.38	3,111.50	3,288	4,584.26 1)	56,312 1)	7,049 1)	5,529.4 1)
b. Développement des fils conducteurs en kilomètres	98,089.43	22,378.8	4,837.5	50,822	42,474	17,656	6,432	26,728	128,532	161,157.8	5,505	50,063	67,005 1)	10,075.08	5,725.00	11,276	5,576.97	111,061 2)	18,058 2)	12,639.5
II. Bureaux.																				
a. Nombre des bureaux. Ouverts au service intérieur et internat.	3,058	755	220	1,657	764	522	108	214	3,463	5,474	10	511 1)	1,318	148	120	281	51	457 3)	190 3)	707
Ouverts au service intérieur seulement.		—	4	2	—	—	61	1	—	—	—	259	—	—	--	1	—	876 4)	130	—
Totaux	3,058	755	224	1,659	764	522	169	215	3,463	5,474	10	770	1,318	148	120	282	51	1,333	320	707
b. Nombre des bureaux De l'Etat	1,391	392	224	712	346	405	105	213	2,071	3,654	10	198	789	95	111	145	51	650	111	629
Des chemins de fer ou Compagnies privées	1,667	363 1)		945	418	117	62	1 1)	1,257	1,815	—	567	497	52	1 1)	137	—	681	209	78
Sémaphoriques avec service télégraphique	—	—	—	2	—	—	2	1	135	5	—	5 2)	32	1	8 2)	—	—	2	—	--
Totaux	3,058	755	224	1,659	764	522	169	215	3,463	5,474	10	770	1,318	148	120	282	51	1,333	320	707
c. Nombre des bureaux Avec service permanent	30	6	2	47	78	13	2	75	10	35	6	610 3)	70	1	6	3	—	686 5)	3	5
Avec service de jour complet	1,960 2)	26	139	363	150	160	125	55	1,831 1)	5,413	—	66	203 2)	103	44	183	16	351 6)	49	46 2)
Avec service de jour limité	1,068	723	83	1,249	536	349	42	85	1,622 2)	26	4	94	1,045	44	70	96	35	296	268	656
Totaux	3,058	755	224	1,659	764	522	169	215	3,463	5,474	10	770	1,318	148	120	282	51	1,333	320	707
d. Nombre des bureaux de dépôt	—	—	2	13	—	278	—	—	—	31 3)	—	— 4)	4	—	—	—	—	142 7)	4	34
III. Appareils.																				
Nombre d'appareils en service Système Morse	3,157	704	368	1,245	1,069	874	207	408	2,420	1,734	30	553	1,511	187	175	325	89	1,489 8)	444	933
Système Hughes	88	10	4	40	8	14	—	—	217	26	—	—	39	—	—	20	—	76	—	22
Autres systèmes	8	475 2)	—	—	4 1)	22 1)	—	—	1,510	5,782	—	—	—	65 1)	12 3)	—	—	—	192 4)	—
Totaux	3,253	1,189	372	1,285	1,081	910	207	408	4,147	7,542	30	553	1,550	252	187	345	89	1,565 9)	636	955
IV. Personnel.																				
a. Personnel supérieur et de l'Administration centrale	261	25	11	163	83	50	16	31	376	644	36	465	225	22	59	40	19	255 10)	20	28 3)
b. Nombre des employés des bureaux	4,519	218 3)	87	1,351	1,039	694	251 1)	956	3,303	6,323 4)	79	927	1,769	344	359 4)	612	171	3,421 11)	338 5)	1,055 4)
c. Personnel subalterne	789	79	30	1,236	283	836	141	839	1,581	3,609 5)	344	1,322	1,536	216	232 5)	262	165	1,805 12)	173 6)	51
Totaux	5,569	322	128	2,750	1,405 2)	1,580 2)	408	1,826	5,260	10,576	459 2)	2,714	3,530	582	650	914 1)	355	5,481	531	1,134
V. Dépêches.																				
a. Service intérieur. Nombre des dépêches soumises à la taxe (expédiées)	6,511,375	539,444	228,585	2,818,697	2,013,471	1,585,196	237,902	839,446	5,395,762	15,369,894	—	606,294	3,308,866	344,695	177,856	1,217,837	188,060	2,527,468	551,802	1,480,757
Nombre des dépêches affranchies de la taxe (expédiées)	272,158 3)	61,110	—	3,714 1)	2,530	4,148	—	182,315	608,700	165,886 6)	—	5,008	147,730 3)	—	32,933	—	12,221	24,235 13)	12,017 7)	17,528 5)
Totaux	6,783,533	600,554	228,585	2,822,411	2,016,001	1,589,344 3)	237,902	1,021,761	6,004,462	15,535,780	—	611,302	3,456,596	344,695	210,789	1,217,837	200,281	2,551,703	563,819	1,498,285
b. Service internat. Nombre des dépêches expédiées à l'étranger	1,443,972	334,068	168,868	715,690	82,995	310,261	107,438	93,528	827,581	1,002,216	20,199	25,849	337,760	95,657	32,953	274,728	5,156	246,030	111,783	251,707
Nombre des dépêches reçues de l'étranger	1,554,079	362,841	181,167	638,721	87,344	350,262	109,331	102,315	914,153	869,107		24,613	364,485	111,659	34,954	310,223	5,261	250,679	113,211	246,597
Nombre des dépêches ayant transité d'une frontière à l'autre	354,739	278,768	47,394	501,189	170,522	157,496	129,881	37,049	306,207	— 7)		27,632	161,254	22,330	10,735	215,885	1,772	27,577	62,601	150,158
Totaux	3,352,790	975,677	397,429	1,855,600	340,861	818,019 3)	346,650	232,892	2,047,941	1,871,323 8)	20,199	78,094	863,499	229,646	78,642	800,836	12,189	524,286	287,595	648,462
c. Nombre des dépêches de service	21,718 4)	—	176,287	118,116	258,086	790,711 4)	18,765 2)	49,607	— 5)	—	—	36,945	125,379 4)	30,355	29,849 6)	12,416 2)	16,181 2)	183,563 14)	863,874 8)	25,111 6)
Totaux généraux du nombre des dépêches	10,158,041	1,576,231	802,301	4,796,127	2,614,948	3,198,074	603,317	1,304,260	8,052,403	17,407,103	20,199	726,341	4,445,474	604,696	319,280	2,031,089	228,651	3,259,552 15)	1,715,288	2,171,858
VI. Recettes.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.	Fr. Ct.
a. Produit des correspondances intérieures	6,521,865.—	312,053.40	182,059.—	6,520,815.—	2,493,213.80	867,448.25	234,567.—	1,032,235.—	6,796,488.45	19,929,125.—	1,035,900 3)	2,968,407.50	4,351,357.85	570,263.26	230,062.08	790,613.41	563,585.06	13,883,353.18 16)	827,440.—	830,300.89 7)
b. Produit des correspondances internationales	5,469,499.— 5)	718,196.75	189,118.—		281,350.10	903,598.75 6)	397,242.—	742,179.—	5,108,933.44	4,414,975.— 9)		1,290,287.50	2,170,782.89	415,673.63	108,157.93	560,355.41	38,164.25	2,958,745.06	641,313.—	739,304.42 7)
c. Recettes diverses	127,781.—	9,145.86	10,097.—	627,860.—	127,540.90	2,184.90	15,143.—	—	753,311.35	1,097,550.— 10)	125,985.—	58,480.—	75,421.39	8,287.16	11,013.33 7)	—	1,363.54	278,110.40 17)	308,156.— 9)	105,572.06
Totaux	12,119,145.—	1,039,396.01	381,274.—	7,148,675.—	2,902,104.80	1,773,231.90	646,952.—	1,774,414.—	12,658,733.24	25,441,650.—	1,161,885.—	4,317,175.—	6,597,562.13	994,224.05	319,233.34	1,350,968.82 3)	603,112.85	17,120,208.64	1,776,909.—	1,675,177.37
VII. Dépenses.																				
a. Budget extraordinaire. Frais d'établissement du réseau	1,106,408.—	137,737.43	187,864.—	1,924,532.—	584,981.77	309,384.—	83,153.—	—	1,119,000.—	—	388,500.— 4)	3,655,282.50	638,341.84	182,495.32	18,563.31	196,138.94 3)	63,101.30	2,043,837.20 18)	311,744.—	361,133.34
b. Budget ordinaire. Personnel	8,391,745.—	436,528.14	244,026.—	4,220,220.—	2,264,598.35	1,100,659 6)	429,266.—	2,959,500.—	9,500,000.—	22,842,225 11)	1,335,825.—	6,229,397.50	3,815,716.46	556,012.84	689,053.—	1,260,931.94	803,721.08	7,412,941.24	810,126.— 10)	880,597.50
Frais d'exploitation et d'entretien des lignes et des bureaux	3,534,713.—	247,170.86	132,345.—	2,767,750.—	1,604,598.08	759,300	152,509 —	529,880.—	3,195,000.—		478,100.—	517,987.50	1,113,633.79	323,786.70	122,460.83	713,729.12	247,087.93	5,499,992.78 19)	284,020.— 11)	392,099.64
Totaux des dépenses du budget ordinaire	11,926,458.—	683,699.—	376,371.—	6,987,970.—	3,869,196.43	1,859,959.—	581,775.—	3,489,380.—	12,695,000.—	22,842,225.—	1,813,925.—	6,747,385.—	4,928,350.25 4)	879,799.54	811,513.83	1,974,661.06 3)	1,050,809.01	12,912,934.02	1,094,146.—	1,272,697.14
VIII. Données générales.																				
a. Population de l'Etat d'après les recensements	34,378,253 6)	4,852,026	1,818,484	20,394,498	15,417,327	5,113,680	1,784,741 8)	16,732,052	36,102,921	31,628,338	—	236,523,542 5)	26,801,154	1,763,000	3,829,618	3,637,279	20,052,890 8)	78,394,471	4,250,402	2,670,345
b. Superficie de l'Etat en kilomètres carrés	449,073.7	75,885	15,657.298	300,432	313,624	29,455	39,375	507,036	514,102	314,968.8	—	4,124,288 6)	296,012	314,864	89,625.31	32,874.88	1,528,237	20,507,601	441,620 12)	41,418

Journal télégraphique — April 1874

ideas and achievements

GUGLIELMO MARCONI

(1874-1937)

One hundred years ago, on 25 April 1874, Guglielmo Marconi was born in Bologna, the younger son of a wealthy Italian landowner, Giuseppe Marconi, and his Irish wife Annie, the daughter of Andrew Jameson, the whisky distiller from County Wexford in Ireland.

To Guglielmo Marconi must go the credit for seeing the wider possibilities of wireless, of taking it out of the laboratory and developing practical systems for the benefit of mankind. His work, and that of the brilliant men with whom he surrounded himself in the company he formed, laid the foundations of the electronics industry as we know it today.

From an early age he was interested in science and by his late teens, at his home the villa Grifone, he was experimenting with electro-magnetic waves as a commucation medium. By the summer of 1895 he had succeeded in transmitting signals over a few metres of space and in August, using an earth and an elevated aerial at both transmitter and receiver, he was able to pass Morse code over a distance of nearly 3 km.

In 1896 Marconi went to England where he filed the world's first patent for a system of telegraphy using hertzian waves. A letter of introduction to William Preece, Engineer-in-Chief of the General Post Office, led to a series of demonstrations culminating in 1897 in a record transmission across 14 km of the Bristol Channel, where Preece himself was experimenting with inductive methods, with far less success.

The potential of wireless telegraphy was becoming clear and in 1897 the world's first radio company was formed to develop Marconi's apparatus commercially. First called the Wireless Telegraph and Signal Company, it was later renamed Marconi's Wireless Telegraph Company and, in 1963, The Marconi Company.

By the end of the century, wireless had been adopted by the British and the Italian Navies, it had spanned the English Channel, it had proved its worth to the mercantile navy as a life saver and Marconi had introduced his system to the United States, where he registered the Marconi Wireless Telegraph Company of America —later to become the Radio Corporation of America (RCA).

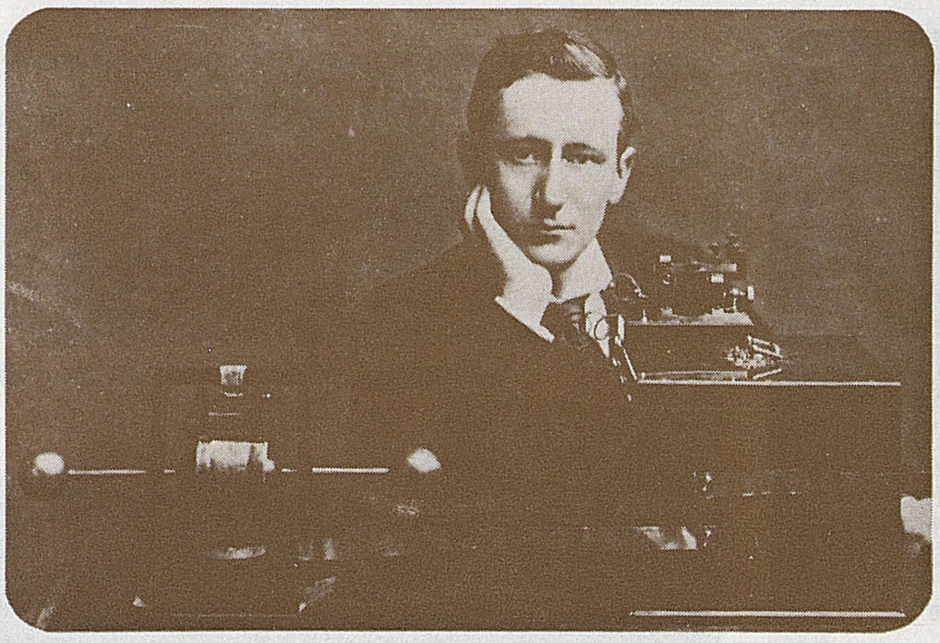
One of Marconi's ambitions had been to use wireless as a means of ending the isolation of those at sea, and in 1900 the Marconi International Marine Communication Company was created to work an exclusive licence for all maritime purposes. At this time also he took out his famous Four Sevens patent for tuned coupled circuits.

In 1901, the world's first wireless school opened at Frinton (England), later transferring to Chelmsford where it still flourishes as Marconi College. This was a vintage year for Marconi. Having achieved communication over 319 km between the Isle of Wight and the Lizard, he embarked, with the assistance of Dr. J.A. Fleming, Scientific Adviser to the company, R.N. Vyvyan, G. Kemp and P.W. Paget, on his famous transatlantic experiment. After many vicissitudes he succeeded in receiving, through an earpiece, signals at St. John's Newfoundland, transmitted from Poldhu, Cornwall.

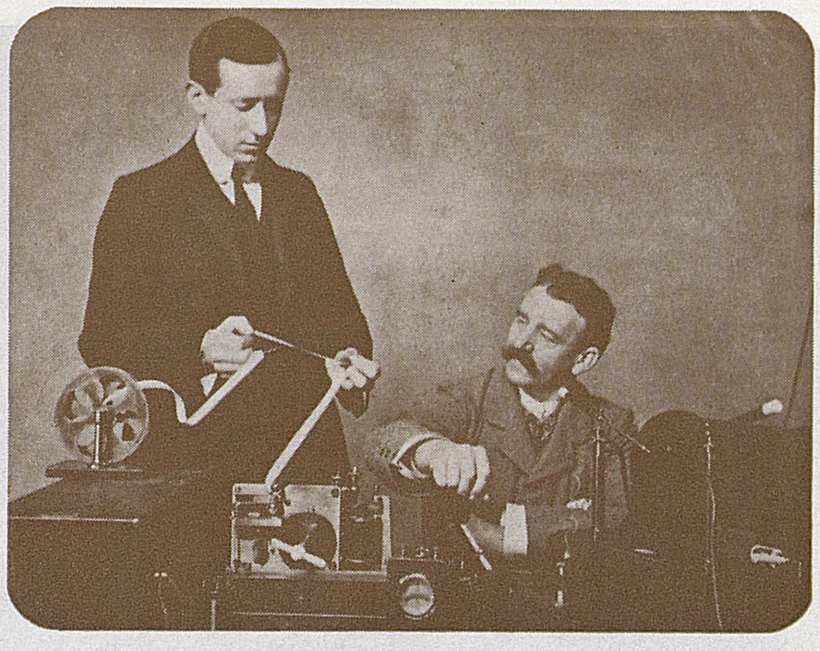
Two months later, signals from Poldhu where recorded on a Morse inker on *SS Philadelphia* — 3378 km away. In December 1902, Poldhu's permanent opposite number was built at Glace Bay.

GUGLIELMO MARCONI

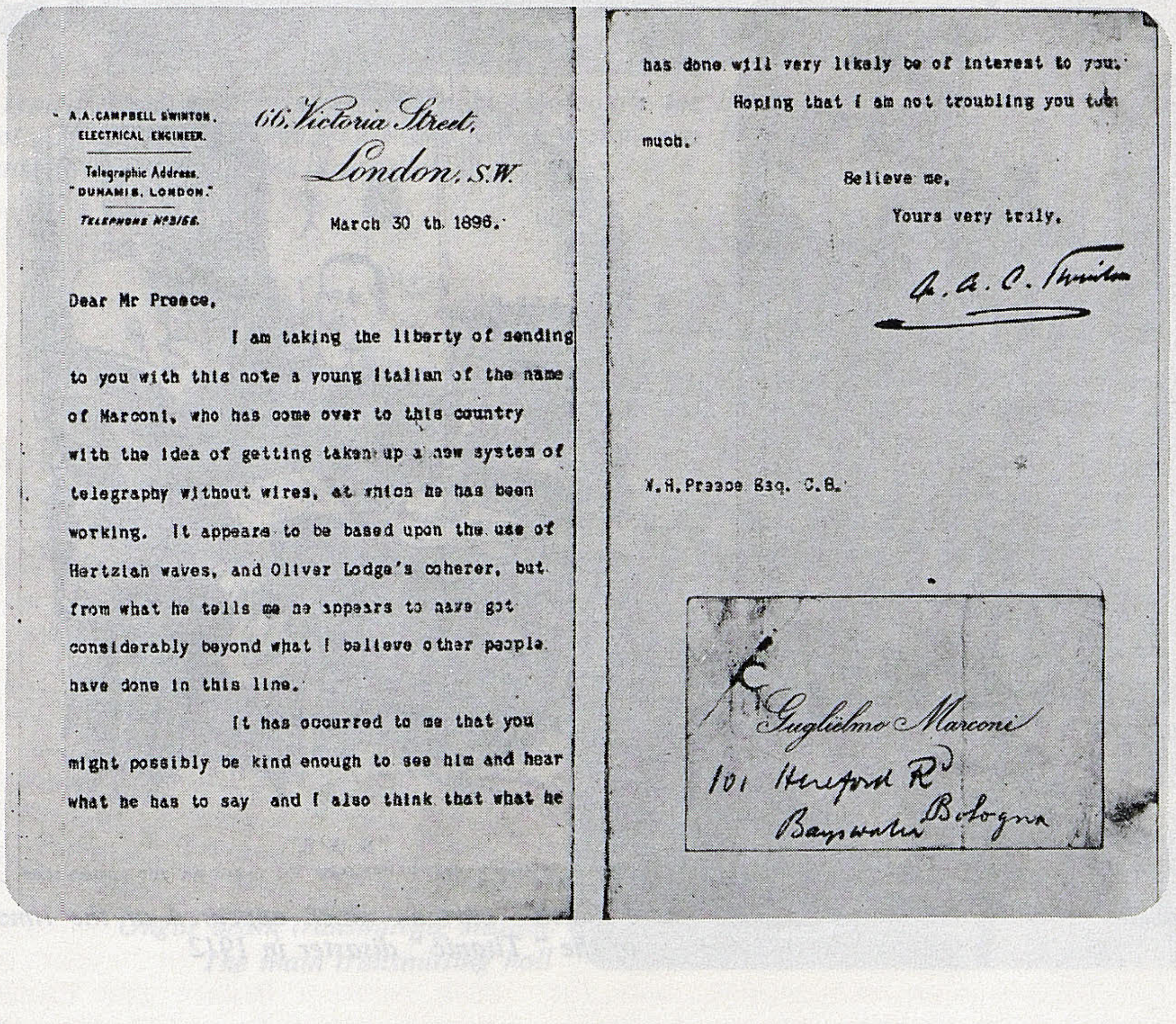
1874-1937



The young Marconi photographed shortly after his arrival in England in 1896, with his apparatus for " telegraphy without wires "



Guglielmo Marconi (left) and George Kemp, shortly after the successful transatlantic test of 1901. On the right is the 25 cm induction coil spark transmitter, with Morse inker and 'grasshopper' key in centre



A.A. CAMPBELL SWINTON.
ELECTRICAL ENGINEER.
Telegraphic Address.
"DUNAMIS, LONDON."
TELEPHONE Nº3156.

66, Victoria Street,
London, S.W.

March 30 th 1896.

Dear Mr Preece,

I am taking the liberty of sending to you with this note a young Italian of the name of Marconi, who has come over to this country with the idea of getting taken up a new system of telegraphy without wires, at which he has been working. It appears to be based upon the use of Hertzian waves, and Oliver Lodge's coherer, but from what he tells me he appears to have got considerably beyond what I believe other people have done in this line.

It has occurred to me that you might possibly be kind enough to see him and hear what he has to say and I also think that what he has done will very likely be of interest to you.

Hoping that I am not troubling you too much.

Believe me,

Yours very truly,

A. A. C. Swinton

W.H.Preece Esq. C.B.

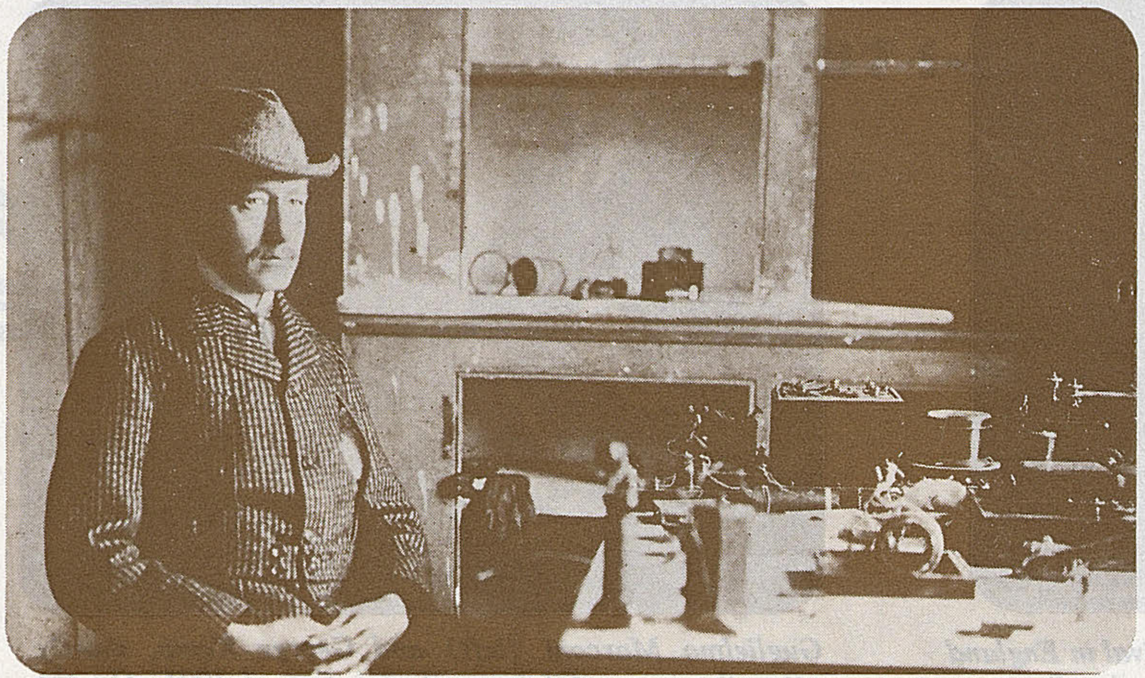
Guglielmo Marconi
101 Hereford Rd
Bayswater Bologna

The letter of introduction from A.A. Campbell Swinton, a well-known engineer of his day, which Marconi took to William Preece, Engineer-in-Chief of the Post Office. The original is in the Post Office archives

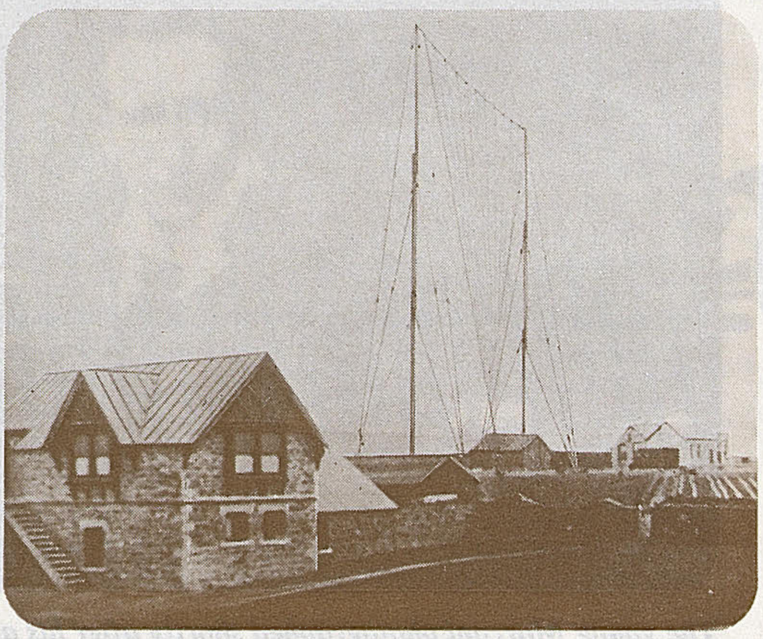
(*Illustrations:* The Marconi Company Ltd.)

GUGLIELMO MARCONI

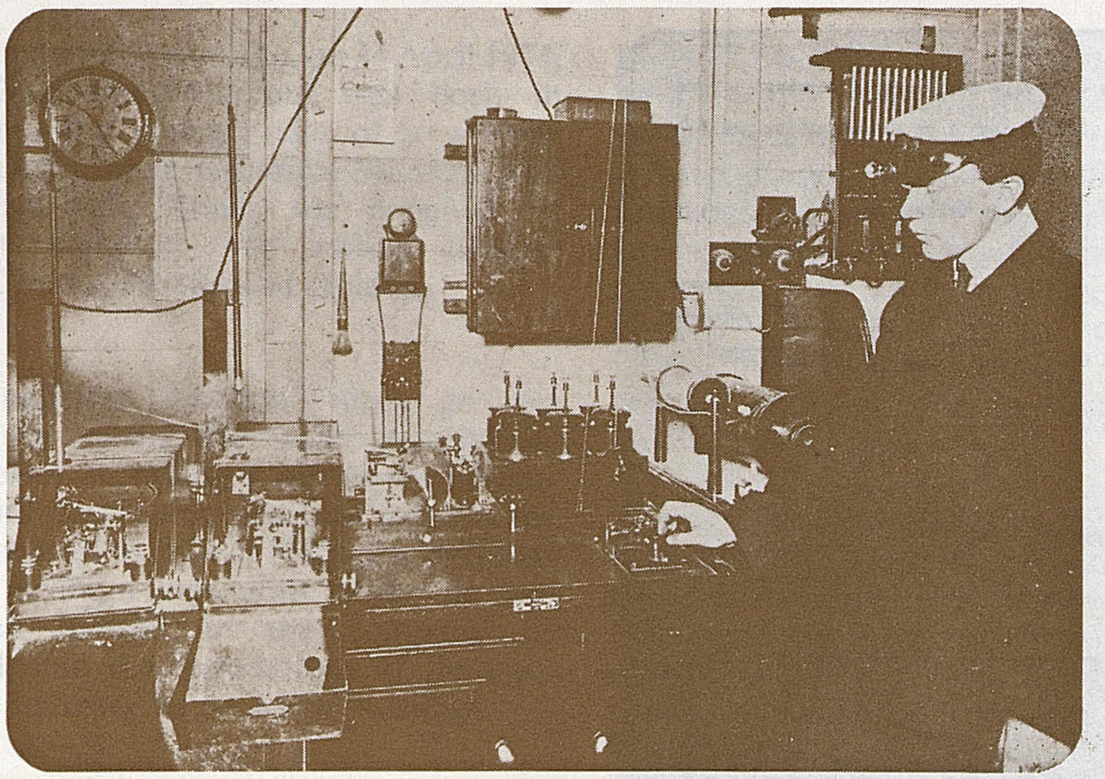
1874-1937



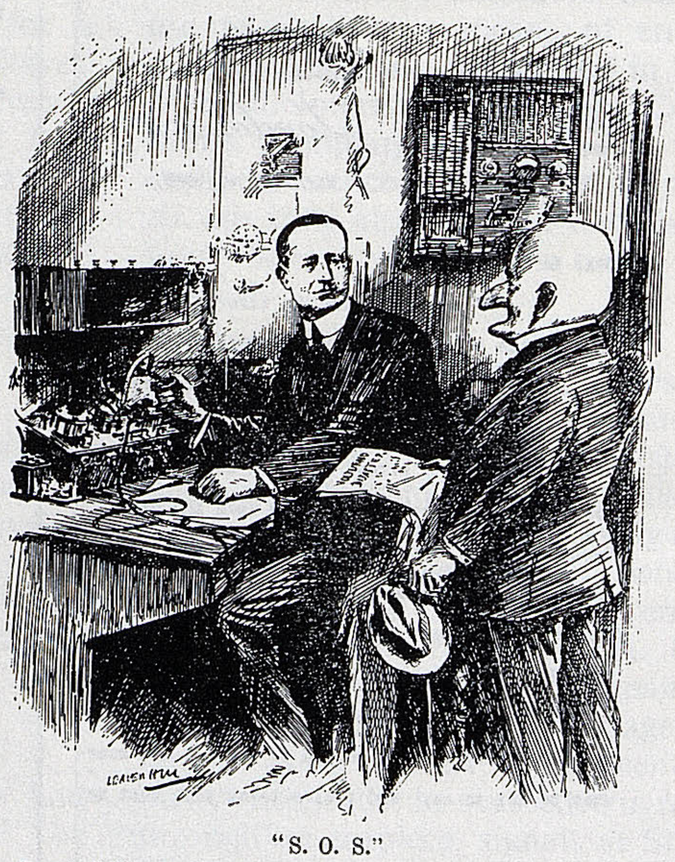
Marconi at Signal Hill, Newfoundland, in 1901 with the instruments with which he received the first wireless signal across the Atlantic from Poldhu, Cornwall



Poldhu wireless station in 1901 with the fan-shaped aerial which sent the first wireless signal across the Atlantic to Signal Hill



An early ship's wireless room —" SS Minnetonka", 1904



"S. O. S."

PUNCH (*to Mr. Marconi*). "MANY HEARTS BLESS YOU TO-DAY, SIR. THE WORLD'S DEBT TO YOU GROWS FAST."

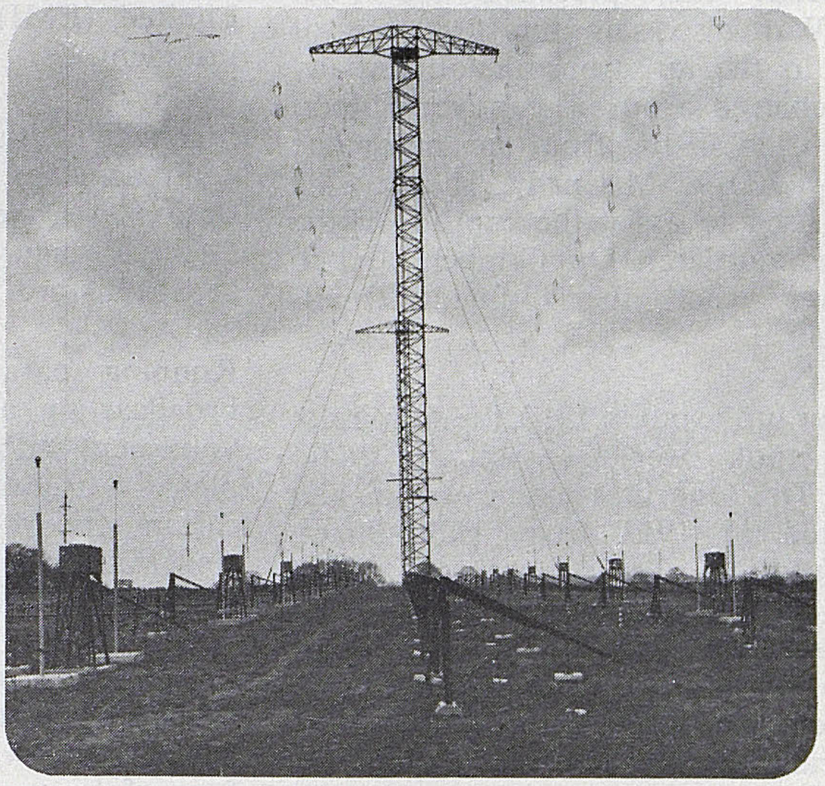
" Punch " cartoon which appeared at the time of the " Titanic " disaster in 1912

(*Illustrations:* The Marconi Company Ltd.)

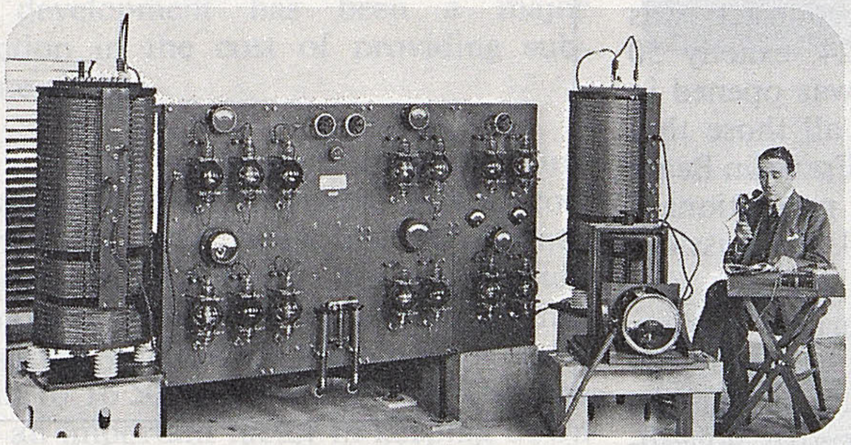
GUGLIELMO MARCONI

1874-1937

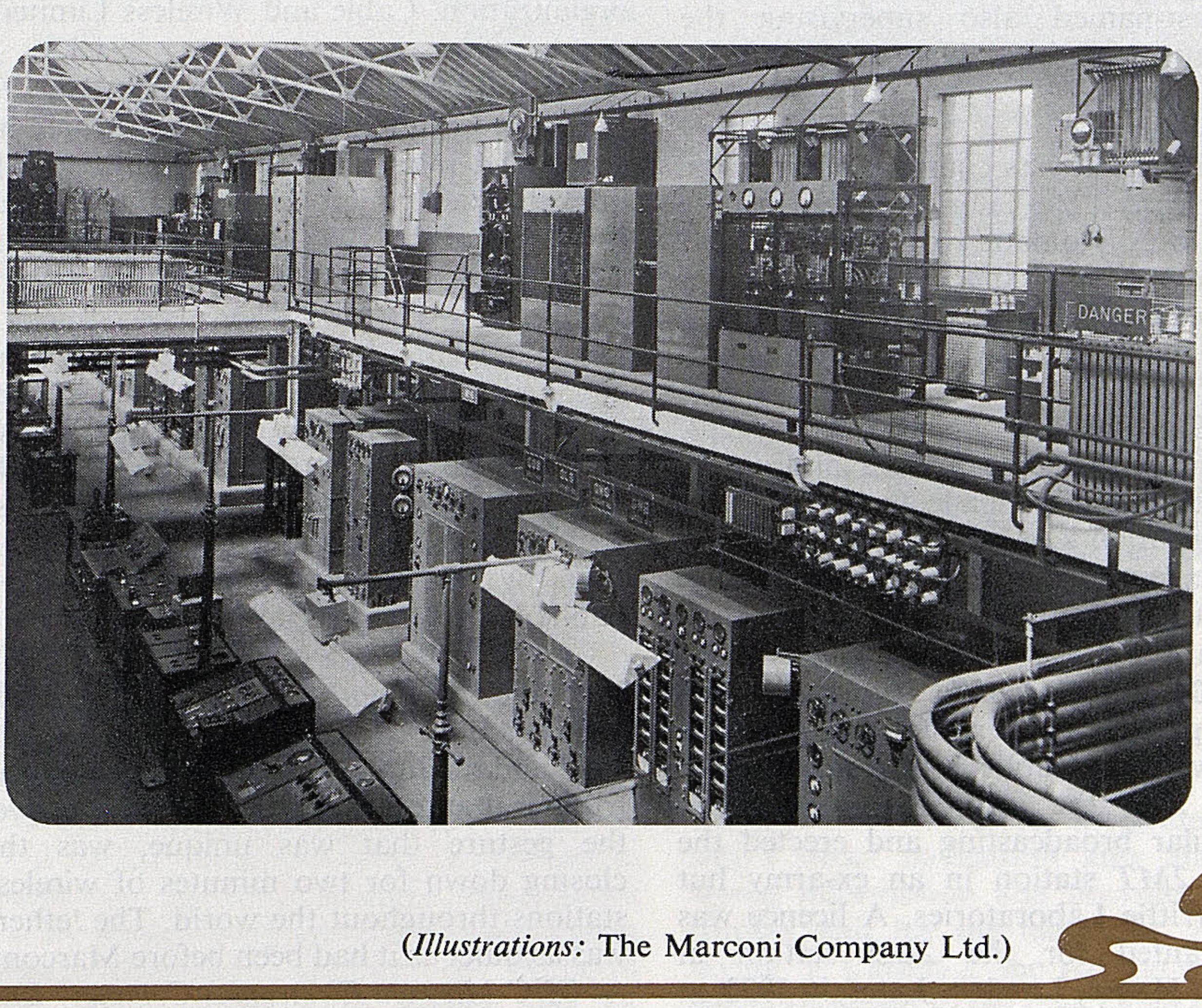
Raising the kite aerial at Signal Hill



The world's first wireless telephony news service was inaugurated on 23 February 1920, at the Marconi Works in Chelmsford with this 6 kW transmitter, using a wavelength of 2500 m



A typical beam radio station set up by Marconi's for the Post Office in the 1920s. This one, at Grimsby, was for transmitting to India and Australia



Ongar beam transmitting station. The main transmitting hall

(*Illustrations:* The Marconi Company Ltd.)

During the next few years many important patents were filed, notably those for the magnetic detector, the radio valve developed by Dr. Fleming, and the directional aerial, which was used at Clifden in Ireland—a station that took over the transatlantic service from Poldhu. In 1909, Marconi shared a Nobel Prize for Physics in recognition of his contribution to wireless telegraphy.

The decade that preceded the First World War also saw the first use of wireless in the air, transmission initially being achieved from a captive balloon and then, in 1910, from an aeroplane flown by J.D.A. McCurdy. It also saw wireless used to assist the capture of the notorious murderer, Dr. Crippen, and to save lives when the ill-fated *Titanic* foundered.

When war broke out in 1914, the Admiralty at once took over the Marconi radio factory. This, the first in the world, had transferred in 1912 from Hall Street, Chelmsford, to a new, purpose-designed building in the same town. The Clifden station and Marconi's operational equipment in Chelmsford and London were also taken over, along with the first longwave transatlantic wireless station for direct communication with the United States, completed by Marconi during 1914.

Air-to-ground telegraphy was perfected and the difficulties of ground-to-air telephony were overcome by three Marconi engineers, Major C.E. Prince, Captain H.J. Round and Lieutenant J.M. Furnival—the last-named also supervising the achievement of interplane telephony in 1917.

Marconi himself was commissioned in the Italian Army. He later became heavily engaged on diplomatic work for Italy and after the war was appointed Plenipotentiary Delegate to the Paris Peace Conference.

In 1919, Marconi bought his yacht, *Elettra*, which he equipped as a laboratory; a Marconi engineer made the first east to west transatlantic telephony transmission; and the embryo of broadcasting took shape in Chelmsford.

In 1920, at Marconi's Works, Nellie Melba gave a song recital for Britain's first advertised public broadcast. Twenty months later the company was licensed for regular broadcasting and erected the famous *2MT* station in an ex-army hut at its Writtle Laboratories. A licence was also granted for the *2LO* station in Marconi House, London. Later, in 1922, at the instigation of the Postmaster-General Marconi's and five other manufacturers formed the British Broadcasting Company, superseded in 1926 by the British Broadcasting Corporation (BBC).

The Marconiphone Company, formed in 1922 to satisfy the demand for domestic receivers, was sold to RCA in 1929 and later merged with two other companies to become Electric and Musical Industries Limited (EMI), of which Marconi was President.

Meanwhile, the company supplied the equipment for the BBC's new longwave station at Daventry, which took over the *5XX* call sign of an earlier station built at Chelmsford.

Running parallel with the company's broadcasting activity was Marconi's involvement with the British Government's plan for a government wireless communication network. First mooted in 1906, the Imperial Wireless Chain contract was awarded to Marconi in 1924, exactly 50 years ago. The first station was opened in 1926 and, in common with all those that followed, used the Marconi-Franklin Beam System—a newly developed, revolutionary form of shortwave directional transmission.

The success of the Imperial Wireless Chain so threatened the interests of certain cable companies that, in 1929, at the instigation of the respective governments, their interests were merged with those of the Marconi Company in a new organization, Cable and Wireless Limited.

At this time ill-health led Marconi to return to his home in Italy, from which he conducted microwave experiments, installing the first microwave telephone link in 1932, and in 1935 demonstrating principles of radar.

Meanwhile his company in England was advancing the new medium of television, its interests in which it merged with those of EMI to form The Marconi-EMI Television Company Limited (later dissolved) whose system was adopted in 1936 by the BBC for the world's first public high definition television service.

In Italy, Marconi's health was deteriorating rapidly. He was taken ill on 19 July 1937 and died the following day. Of all the tributes that followed, the most impressive, the gesture that was unique, was the closing down for two minutes of wireless stations throughout the world. The 'ether' was as quiet as it had been before Marconi. — *GEC-Marconi Electronics Company Ltd.*

" Cantat-2 "

The laying of *Cantat-2*, a new telephone cable between Britain and Canada, was completed on 8 December 1973. The cableship *Mercury*, after laying the final section, joined the cable into one continuous length of 2805 nautical miles, 170 miles off the Canadian coast—6 days ahead of schedule.

Cantat-2 is the biggest single telephone cable across the Atlantic. It can carry up to 1840 telephone conversations simultaneously, more than the combined capacity of all the other telephone cables spanning the Atlantic.

Financed and operated jointly by the United Kingdom Post Office and the Canadian Overseas Telecommunication Corporation (COTC), the 30 million pounds sterling cable has been provided to meet the massive growth in telecommunications between the United Kingdom and North America. In 10 years telephone calls between Britain and Canada have risen eightfold from 135 000 calls a year in 1962 to their present level of more than 1 million a year. This will rise again to nearly 6 million a year by 1980. Growth in calls between the United Kingdom and the United States has risen from 1/2 million in 1962 to more than 4½ million in a year in 1972, and by 1980 this will have reached 24 million a year.

The laying of Cantat-2, which was manufactured by the Submarine Systems Division of Standard Telephones and Cables Limited (STC) comes 20 years after the United Kingdom and the United States decided to lay the first telephone cable across the Atlantic. Until then only telegraph cables spanned the Atlantic and telephone calls went by high frequency radio. That cable, *TAT-1*, which is still in service, could originally carry only 36 telephone calls, compared with the 1840 of Cantat-2.

This significant increase in call-carrying capability has been achieved by continuing development in the field of high-capacity undersea cables by the Post Office, working closely with industry. Another result of this development has been a major reduction in the cost of providing submarine cables.

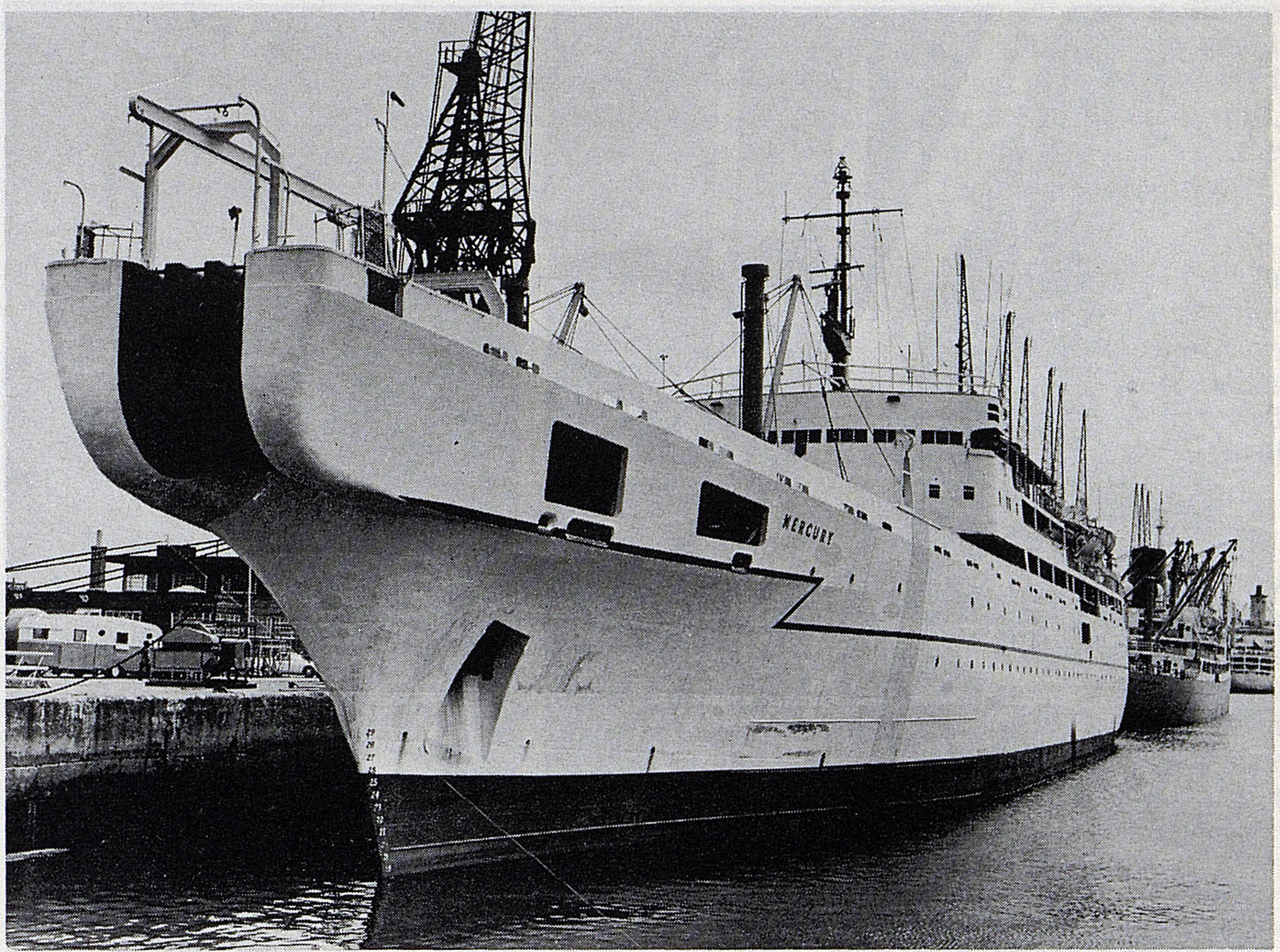
For example, each circuit in the first transatlantic telephone cable system cost at the time more than 294 000 pounds sterling. In Cantat-2 the application of modern transmission techniques has dramatically reduced the cost of each circuit to 16 500 pounds sterling. This has been an important factor in keeping down the cost of transatlantic telephone calls.

Navigation

The route of Cantat-2 was planned with extreme care. Seabed surveys of the mid-Atlantic ridge were carried out in 1971 by the Canadian icebreaker/cable layer *John Cabot* and the French cableship *Marcel Bayard* with Post Office marine specialists on board. Detailed information about the Atlantic seabed was also obtained from the British and Canadian Hydrographic Offices, the Canadian National Institute of Oceanography, and the Bedford Institute of Oceanography in Canada.

The route chosen picks a careful path down the slopes of the continental shelves and through the valleys and passes of the mid-Atlantic ridge to give as regular a seabed as possible on which to lay the cable.

" Mercury ", laying the deep-water section of Cantat-2, was fitted with one of the most accurate navigation systems commercially available to enable her to chart the cable route with extreme accuracy. The system, called *Hydroplot*, was developed for the Hydrographic Department of the Royal Navy and uses United States Navy navigation satellites to pinpoint the ship's position to within 100 m. An *Elliot 905* computer integrates all the ship's other navigation aids and cable-laying information and provides a visual display unit for the navigator. After the laying of Cantat-2, the navigation system was transferred to the Post Office cableship



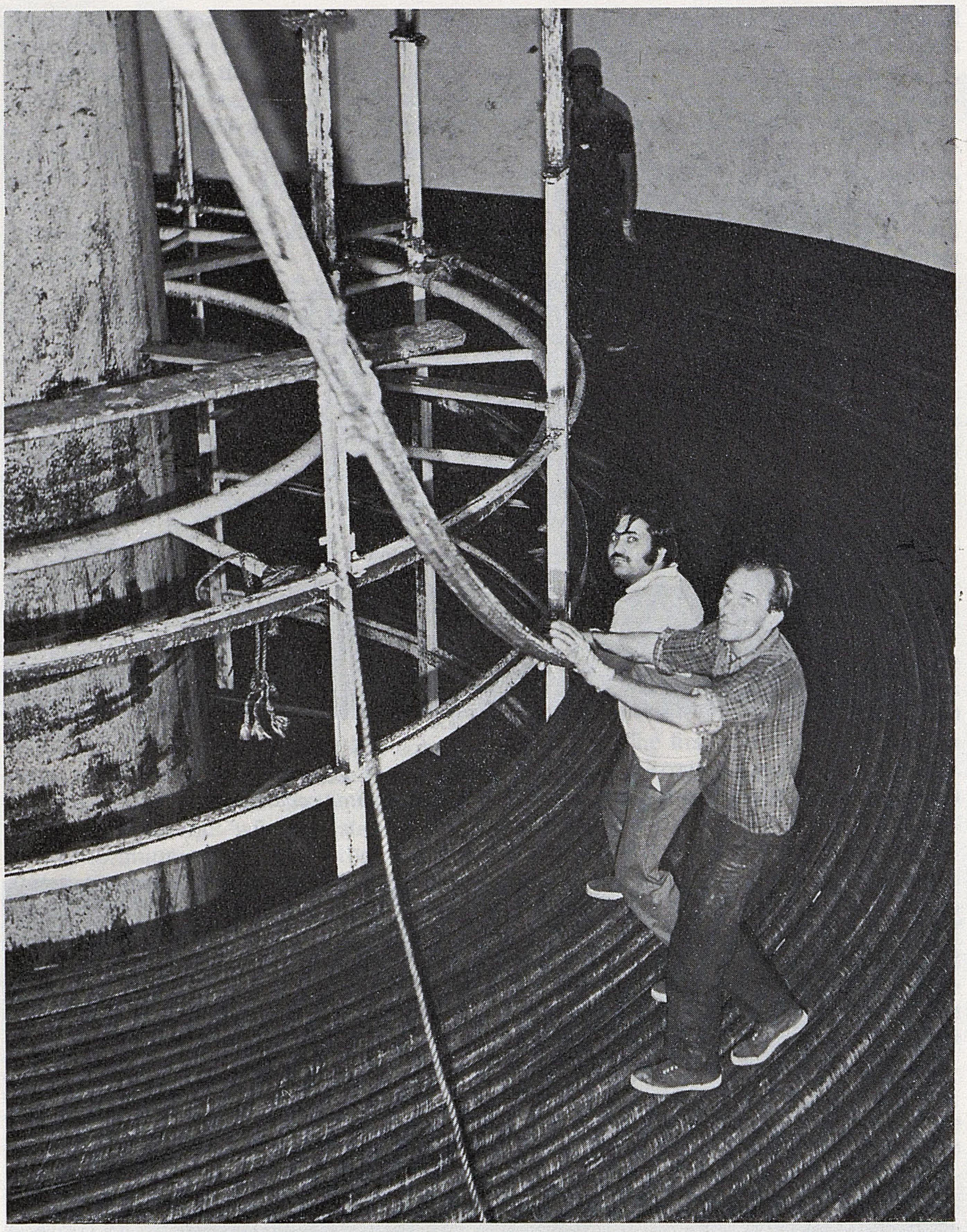
(David J. Smith)

The Cable and Wireless cableship " Mercury " (8962 tonnes) loading part of the armoured section of Cantat-2 while berthed at the quayside at STC's Southampton cable plant

VICKERS
Oceanics
PIII

(United Kingdom Post Office)

Miniature submarine used to bury part of Cantat-2 some 40 cm beneath the seabed as protection against damage by fishing trawlers



(David J. Smith)

Armoured cable of Cantat-2, an undersea telephone cable system from the United Kingdom to Canada, being loaded into one of the cable tanks on board the Cable and Wireless cableship " Mercury "

Alert, which is responsible for the maintenance of transatlantic cables. This is of vital importance in speeding repair operations, for if the need arises to recover a section of the cable, the satellite navigation system will enable the repair ship to locate accurately and quickly any part of it.

Repeaters

Cantat-2 has 473 repeaters. In the deepest parts of the Atlantic repeaters are under a pressure of 45 megapascals and are protected by deep-sea pressure housings developed by the Post Office and STC.

Transistors

2800 transistors are used in the amplifiers in Cantat-2, each with a design life of at least 25 years. The transistors have been produced by the Post Office Research Department at Dollis Hill, London, and supplied to STC for installation in the repeaters. To ensure the reliability of the transistors used in the cable system, the Post Office tested exhaustively a further 18 000—which will never be used operationally.

Great attention was paid to eliminating all causes of failure. A new method of bonding the very fine lead wires to the semi-conductor chip overcame a hitherto dominant weakness. Over 100 000 such bonds have withstood testing. Already this type of transistor, on the seabed in earlier systems, has achieved 65 million device-hours without a single failure.

Equalizers

Cantat-2 also has 31 equalizers, spaced at approximately 90-mile intervals in the cable and placed in pressure housings similar to a repeater. Equalizers are electrical circuits designed to compensate for variations in the match between repeater gain and cable loss. The electrical characteristics of the cable are altered when it is placed in the sea, and equalization compensates for the differences between the predicted and actual change.

Equalizing these differences ensures that the performance of telephone circuits over the whole of Cantat-2's frequency range will be virtually identical. The equalizer is initially assembled at the cable works and finally completed at sea during the course of laying operations.

Circuits

Cantat-2's 1840 circuits are arranged as 23 super-groups, transmitting in the frequency band 312 to 6012 kHz in the United Kingdom—Canada direction and 8000 to 13 700 kHz in the Canada—United Kingdom direction. In addition four speaker circuits, of nominally 3 kHz bandwidth each, use the frequency bands 6024 to 6036 kHz in the United Kingdom—Canada direction and 7976 to 7988 kHz in the Canada—United Kingdom direction, for system and circuit maintenance.

The cable itself is predominantly of lightweight design and weighs no more than 3 tonnes per kilometre. Less than 50 mm in diameter for most of its length, the cable has an outer conductor of aluminium. Its strength is centred in a steel rope inside an inner copper conductor. External armour will be used to protect the cable at the United Kingdom shore end.—*United Kingdom Post Office/COTC.*

"Spector": a telegraph error-correcting system

A potent error-correcting system which, for the first time, raises the reliability of radio teleprinter communication over marine and point-to-point radio circuits to a level suitable for connection to international telegraph networks, has been introduced by Marconi Communication Systems Limited.

Known as *Spector*, the new system gives ship, mobile and remote HF radio stations using single frequency working, direct access to fixed telegraph networks, which previously has not been practicable. To accommodate all operational requirements, provision is made for two modes of operation—ARQ (automatic repeat on request) for point-to-point, and FEC (forward error correction) for broadcast traffic. Selective calls can be made in either mode.

A major factor which has up to now prevented the replacement of most conventional hand Morse circuits by radio teleprinter circuits has been the impossibility of guaranteeing reliable error-free communication without a radio operator. An unprotected HF radio circuit is liable to interference, fading and bursts of static that often mutilate whole sections of a message. Before connecting such a circuit into a public telegraph or telex network, an effective means of error control is required.

Spector, which has been developed to meet CCIR Recommendation 476 (Revised 1972), is designed to do just this. In the ARQ mode, on receipt of mutilated characters it will automatically request a repetition of these characters until they are received correctly, ensuring virtual error-free communication. When used in the FEC mode the system is capable of detecting and correcting or indicating most errors.

The ARQ mode is normally preferred for ordinary traffic because the transmitted message will be received at the other end with certainty. Under conditions where the distant radio transmitter cannot be used for ARQ, or when the same message must be sent to several stations simultaneously, the FEC mode provides a means of getting the message across with a minimum of errors.

Apart from making available the obvious advantages of radio teleprinter working in terms of speed and the provision of printed copies, Spector enables a coast station to extend an inland telegraph connection to a similarly equipped station anywhere in the world.

The selective calling facility permits any station to call and to pass messages to any other station in privacy. Unattended operation is possible when necessary.

Spector comprises a sender unit, including an input buffer store, which is interposed between the output of a teleprinter and the radio transmitter, and a receiver unit, interposed between the output of the radio receiver and the teleprinter input.

The error-detecting principle employed in both the ARQ and FEC modes employs a special 7-unit constant ratio transmission code to which the incoming 7½-element start-stop telegraph code is converted. All received characters, including control characters, are checked for correct ratio.

In the ARQ mode, 7-element characters are transmitted in blocks of 3, with a pause between the blocks. During this pause the receiving station requests either a repeat of the last transmitted block if the ratio check on this failed, or transmission of the next block if the last one was satisfactorily received.

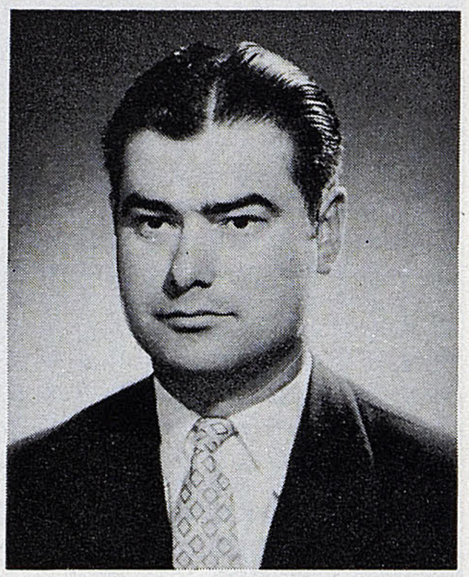
In the FEC mode, each 7-element character is transmitted twice with 4 other characters interposed between the successive transmissions. If on first reception the ratio check indicates that the character is good it is accepted. If not, it is rejected and the same character is examined again on second transmission. If this time it is good it is accepted, but if both transmissions are bad, an error symbol is printed or a space is left in the teleprinter copy.

The sender has facilities for selectively calling a remote station, using 2- or 4-character calling codes, the station identity number being set up by means of thumbwheel switches on the main unit or a keyboard on the remote control unit. A call sign is set up by entering the appropriate station identity which the sender automatically translates into the corresponding Spector selective calling code.

An optional FSK modulator, to convert the DC signals to audio-frequency tones suitable for directly modulating a radio transmitter, can be fitted as an alternative to the DC line unit. Similarly the receiver has provision for an optional detector circuit to convert the AF output of a radio receiver to DC signals. This unit is fitted as an alternative to the DC line receive unit.

The equipment will interwork in both transmission modes with other equipment meeting the CCIR Recommendation. — *Marconi.*

Statistical analysis of demand for telecommunication services in Greece



by
Stylianos K. ATHANASSIOU

1. The purpose of the project

The main objects of the present study are to make a statistical analysis of the demand for telecommunication services, especially telephone connections and calls, offered by the Hellenic Telecommunications Organisation SA (OTE) and to forecast the future development of these services.

The statistical analysis of demand for telecommunication services is based on observations made during the period 1958-1968, on the present state of the OTE, and on hypotheses regarding the factors that influence this demand which are suggested by economic theory.[1] For the purpose of analysis regression techniques will be used. The forecasts of the development of demand up to and including 1975 will facilitate the overall planning of its activities by the Organisation.

The sources used for statistical information are the data kept by the OTE, the National Statistical Office of Greece, the National Accounts of the Ministry of Co-ordination, the Bank of Greece, and the United Nations. The form of the data collected was subjected to processing to suit the purpose it was to serve.

This is the first time that a statistical analysis of demand for telecommunication services and forecasts of their future development have been made on a scientific basis in Greece.

2. Demand for telephone connections

2.1 Basic characteristics

One of the most important telecommunication services is the provision of telephone connections. Telephone connections serve the social and professional activities of the customer who, in specialized terminology, is called a " subscriber ". This service is becoming of increasing importance because

a) there is already an accumulated need for it, and

b) the continuous development of our economy creates fresh needs.

Moreover, telephone connections are an active factor in the Organisation's operations [2] and they tend to be acquired by the public at large.

Finally, a telephone connection can be considered as a durable consumer commodity, since its characteristics are long life, high price and use by the end consumer.[3]

2.2 Form of the demand

The technological ability of the Organisation to meet the demand for such a service is limited. Because of this, part of the demand remains unsatisfied every year. This unsatisfied part is carried over to the next year and, together with the annual demand of that year, forms the total or gross demand for telephone connections.

If we define the demand for telephone connections as the number of applications submitted annually to the Organisation then, as already explained, a number of applications which have not been met will be transferred to the next year, and so on. In other words, every year the Organisation has a waiting list of applications for telephone connections consisting of the sum of the applications submitted in that year and those of the previous years. On the other hand, whether an application for a telephone connection is granted or not depends on many factors, most important of which are the date of submission of the application, the applicant's situation (ocupation, etc.), whether the applicant is a public service, and other factors such as his state of health. The portion of demand that is covered by the Organisation annually may therefore be derived from the annual demand or from the demand carried over from previous years, or partly from both. From this, we can compose the following demand equation

$$TD_t = ED_{n-t} + \Delta D_t \qquad (1)$$

where:

TD = total demand in the year, t

ED = unsatisfied demand of previous years, n-t

ΔD = annual demand in the year, t

t = time unit

n = number of years.

This sub-division of demand for telephone connections is imposed by the existing situation in the service and the available statistical material. In this article we shall concentrate on the annual and total demands. It is impossible to make a separate study of the unsatisfied demand owing to the way in which it is expressed.

2.3 Development of the demand for telephone connections during the observation period 1958-1968

During the observation period 1958-1968 the annual demand for telephone connections rose steadily and by the end of the period (1968) amounted to 100 000 applications. This rate of increase was four times greater than it had been at the beginning of the period in question, the greatest increase being registered in 1966. From table 1 it will be seen that the annual demand in the Greater Athens area fell from 71% of the total for the country to 51%, while in the rest of Greece it increased rapidly from 29 to 49%. The rate of growth of demand was 14.7% per annum, during the period under consideration, while the rates by area were 11.1% in Greater Athens and 20.9% in the rest of the country. In other words, in Greater Athens the rate of growth of the demand under study is half of that for the rest of the country during the years 1958-1968. The difference in the rate of growth of the two areas is due to the differential influence on demand of a number of socio-economic factors which vary with the area, and to the increase in, and composition of, the population of each area. In 1958, demand was distributed in proportions of 71% and 29% between Greater Athens and the rest of the country. These proportions, as can be seen from table 1, change through the period 1958-1968, following a downward trend in the capital district, an upward trend in the rest of the country, and finishing roughly level at the end of the period. This equality of demand for telephone connections as between the two areas reflects the improvement of socio-economic conditions in the rest of the country during the last years of the period.

However, the annual demand for telephone connections does not give a complete picture of the variable under study as formulated by the real technological capacity of the Organisation. The annual demand for this service which could not be met within the year in which it arose went to increase the accumulated demand. In other words, the accumulated total demand, TD, consists of the sum of all the uncovered demands of previous years, ED_{n-t}, and the annual demand, ΔD_t, as in equation *(1)*.

▶

Table 1

Annual demand and its percentage distribution by major areas during the observation period 1958-1968

area	year						average rate of growth (%)
	1958	1960	1962	1964	1966	1968	
— Greater Athens	18038	25610	34875	47898	66112	51418	11.1
index of change	100	142	193	266	367	285	
1:3	71.0	68.0	73.0	67.0	65.0	51.0	
— rest of the country	7343	12274	13160	23945	35738	48778	20.9
index of change	100	167	179	326	487	664	
2:3	29.0	32.0	27.0	33.0	35.0	49.0	

Source: Statistical Yearbook of Telecommunications, *OTE, Athens, 1968*

Table 2

Total demand and its percentage distribution by major areas during the period 1958-1968

area	year						average rate of growth (%)
	1958	1960	1962	1964	1966	1968	
— Greater Athens	92250	111910	112048	136814	188151	182574	7.1
index of change	100	121.3	121.5	148	204	198	
1:3	78.3	75.2	73.3	74.6	68.9	64.2	
— rest of the country	25489	36916	40737	46492	84970	101785	14.8
index of change	100	145	160	182	333	399	
2:3	21.7	24.8	26.7	25.4	31.1	35.8	
— total	117739	148826	152785	183306	273121	284359	9.2
index of change	100	126	130	156	232	241	

Source: Statistical Yearbook of Telecommunications, *OTE, Athens, 1968*

Table 2 gives a complete picture of the total demand in the period 1958-1968.

From table 2 it can be seen that the total demand for telephone connections followed an upward trend during 1958-1968 and by the end of the period had increased 141% (base year 1958). On the other hand, total demand in the Greater Athens area increased 98%, the greatest rise being recorded in 1966, while in the rest of the country it increased 299%. The average rate of growth of total demand in Greece as a whole was 9.2% during the period, while the average rate per area was 7.1% in Greater Athens (despite a drop in 1968) and 14.8% in the rest of the country. The higher rate of growth in the rest of the country compared with Greater Athens, as we have already said, is due to the increased channel demand in this area. The percentage distributions of the demand under study by area are 64.2% in Greater Athens and 35.8% in the rest of the country in 1968, compared with 78.3% and 21.7% in 1958. The proportion of the demand accounted for by each of the areas changes through the period, following a downward trend in the capital district and an upward trend in the rest of the country.

2.4 Economic factors which determine the demand for telephone connections

An analysis of the demand for telephone connections should be based on:

a) definition of the determining factors and their influence on the variable under study;

b) selection of these factors as explanatory variables in the functional equations, and

c) an estimate of the relative influence of each determinant on the demand under study.

The determinants should also be indicated by economic theory and be statistically evaluated. Here we shall attempt to present those factors which may be regarded as determining factors and which can be introduced as explanatory variables in the functional equations. They are as follows:

- *Income*

The customers' income can be considered a determinant of the demand for services. This is the most important factor, because of its high elasticity, which is the characteristic of commodities associated with a high standard of living. [4] Its importance is even greater in a developing country such as the one we are considering, where the standard of living is low and the demand of the inhabitants for durable goods is strong.

- *Distribution of income*

When income is unequally distributed among the inhabitants of the country, we may expect their preferences, i.e. the demand for commodities, to vary. In Greece, the distribution of the national income is unequal. For this reason and others (rural areas, etc.), the demand for telecommunications is almost nonexistent amongst the agricultural population. We have therefore tried to divide national income into urban and agricultural in the functional equations.

- *Population*

The aggregate demand for a commodity consists of the sum of all individual demands. As the population grows, the number of consumers increases and the quantity demanded increases. Population is treated as another exogenous determinant of demand. By eliminating the influence of the factor " population " on the national income, the *per capita* income is defined in its anti-inflationary form. So " population " in the above form is introduced as an explanatory variable in the functional equations of demand.

- *Price*

Another basic factor of the demand for a commodity is its price. The price of telephone connections is expressed in the form of a a lump sum charge.

- *Credit facilities*

The lump sum charge for telephone connections is considered rather high for medium and low income groups. The Organisation therefore grants credit facilities to the subscriber. These consit of the payment of only part of the cost of the telephone connection on its installation and putting into service, the rest being paid over three months in equal monthly instalments.

- *Building activity*

Building activity influences the demand for telephone connections and can consequently be considered a determining factor of the variable under study. The building activity factor can be statistically estimated, while its development is independent of the other factors.

- *Liquid assets*

The consumption decision of the head of the household may be influenced by liquid assets. [5] Therefore, in the analysis of demand for durable goods, liquid assets in the hands of consumers at the end of the preceding year are considered as a determinant. [6]

- *Accumulated needs*

Finally, accumulated needs for telephone connections and imitation can be considered a determining factor of the demand under study.

2.5 Functional equations of the demand for telephone connections

Having defined the factors of the demand in question, let us attempt to formulate the appropriate functional equations. Thus, demand as a function of the urban income determinant as an explanatory variable can be formed as follows:

$$TD_t = f(Y_t^r) + e_t \qquad (2.5.1a)$$

where:

TD = total demand for telephone connections

Y = national income

Y^a = agricultural income

$Y\text{-}Y^a = Y^r$ = urban income

f = symbol of the function

e = residual of the equation

t = time.

The functional equation *(2.5.1a)* expresses the influence of the change in urban income on demand. In section 2.4 it was said that the determining factor " population " can be introduced in the demand functions as an explanatory variable in the form of *per capita* income.

Table 3

Total demand for telephone connections

number	model	estimate of parameters	percentage of Y variance explained by regression (1)	$\overline{R}$ (or $\overline{r}$) (2)	Durbin-Watson d statistic (3)
a) linear form					
1*	$TD_t = a+b\,Y^r_t$	$TD_t = -63834+2.914\,Y^r_t$ (0.223)	95.1	0.975	0.814
2*	$TD_t = a+b\,Y^r_t+c\,P_t/T+d\,TD_{t-1}$	$TD_t = 37997+1.5084\,Y^r_t-33303\,P_t/T+0.58102\,TD_{t-1}$ (0.6623) (26522) (0.25016)	97.2	0.986	1.371
3*	$TD_t = a+b\,Y^r_t+c\,Z_t+d\,TD_{t-1}$	$TD_t = 37798+1.5075\,Y^r_t-132891\,Z_t+0.58129\,TD_{t-1}$ (0.6625) (105875) (0.25029)	96.0	0.979	1.374
4*	$TD_t = a+b\,HI_t$	$TD_t = 31655+17.2109\,HI_t$ (1.6966)	92.0	0.959	1.201
5*	$TD_t = a+b\,PBA^N_t$	$TD_t = 28430+2.1035\,PBA^N_t$ (0.2399)	90.0	0.948	1.602
b) logarithmic form					
1*	$\log TD_t = \log a+b\log Y^r_t$	$\log TD_t = -1.081+1.2862\log Y^r_t$ (0.1007)	95.1	0.975	0.886
2*	$\log TD_t = \log a+b\log Y^r_t+c\log P_t/T+d\log TD_{t-1}$	$\log TD_t = -0.536+0.4583\log Y^r_t-0.5172\log P_t/T$ (0.3446) (0.3566) $+0.7141\log TD_{t-1}$ (0.2866)	97.2	0.986	1.286
3*	$\log TD_t = \log a+b\log Y^r_t+c\log Z_t+d\log TD_{t-1}$	$\log TD_t = -0.844+0.4533\log Y^r_t-0.5196\log Z_t$ (0.3314) (0.3419) $+0.7195\log TD_{t-1}$ (0.2756)	97.3	0.986	1.393
4*	$\log TD_t = \log a+b\log HI_t$	$\log TD_t = 2.1639+0.7864\log HI_t$ (0.0875)	90.0	0.949	1.087
5*	$\log TD_t = \log a+b\log PBA^N_t$	$\log TD_t = 1.1133+0.8529\log PBA^N_t$ (0.0886)	91.2	0.955	1.463

Note: $\overline{R}$ (or $\overline{r}$) = estimate of the correlation in the population, i.e., sample values of R (r) adjusted for degrees of freedom.

Equation *(2.5.1a)* involves taking the urban population into consideration and the equation is consequently modified as follows:

$$TD/N_t\,r = f(Y^r_t/N^r_t)+e_t \qquad (2.5.1b)$$

where:

$TD/N_t\,r$ = total demand for telephone connections per 100 urban inhabitants

N = total population

N^a = agricultural population

$N\text{-}N^a = N^r$ = urban population

Y^r/N^r = *per capita* income of the urban population

The price—lump sum charge—can be introduced as an explanatory variable in the functional equations of the demand for telephone connections. We calculate the average relative price, which is the real price of the service. The above functional equation *(2.5.1b)* is therefore restated as follows:

$$TD_t = f(Y^r_t/N^r_t, P_t/T)+e_t \qquad (2.5.2)$$

where:

Y^r/N^r = as in equation *(2.5.1b)*

P = average annual price of the service

T = price consumer index

P/T = average annual relative price of the service.

▶

Table 4

Annual demand for telephone connections

number	model	estimate of parameters	percentage of Y variance explained by regression (1)	$\overline{R}$ (or $\overline{r}$) (2)	Durbin-Watson d statistic (3)
		a) linear form			
1*	$\Delta D_t = a + b\, Y^r_t$	$\Delta D_t = -58619 + 1.4092\, Y^r$ (0.0889)	96.5	0.982	1.398
2*	$\Delta D_t = a + b\, HI_t$	$\Delta D_t = -12573 + 8.335\, HI_t$ (0.7158)	94.0	0.969	1.806
3*	$\Delta D_t = a + b\, PBA^N_t$	$\Delta D_t = -13291 + 1.00796\, PBA^N_t$ (0.11159)	90.0	0.949	1.573
4*	$\Delta D_t = a + b\, Y^r_t + c\, Kd_{t-1}$	$\Delta D_t = -102652 + 2.3296\, Y^r_t - 0.1313\, Kd_{t-1}$ $(0.4947) \quad (0.0697)$	97.6	0.988	1.499
		b) logarithmic form			
1*	$\log \Delta D_t = \log a + b \log Y^r_t$	$\log \Delta D_t = -5.401 + 2.0616 \log Y^r_t$ (0.1562)	96.0	0.979	1.300
2*	$\log \Delta D_t = \log a + b \log HI_t$	$\log \Delta D_t = -0.2358 + 1.2694 \log HI_t$ (0.1218)	92.3	0.961	1.408
3*	$\log \Delta D_t = \log a + b \log PBA^N_t$	$\log \Delta D_t = -1.8548 + 1.3608 \log PBA^N_t$ (0.1389)	90.0	0.949	1.315
4*	$\log \Delta D_t = \log a + b \log Y^r_t + c \log \Delta D_{t-1}$	$\log \Delta D_t = -3.070 + 1.2610 \log Y^r_t + 0.3450 \log \Delta D_{t-1}$ $(0.7965) \quad (0.3374)$	96.3	0.981	1.628

The functions already formulated need further refinement; for instance, the " credit facilities " determinant can be considered instead of the price. Equation *(2.5.2)* can then be expressed as follows:

$$TD_t = f(Y^r_t / N^r_t,\, Z_t) + e_t \qquad (2.5.3)$$

where:

$Z =$ the amount of the instalment which can be paid in equal periods of time.

Besides income and population, equation *(2.5.3)* incorporates the relative price, the down-payment and the number of instalments, i.e. factors which are taken into consideration by the buyer of the said services.

Finally, the determining factors of building activity, PBA, the stock of telephone connections, Kd_{t-1}, the liquid assets, L_{t-1}, and imitation, which can be expressed by the demand for telephone connections of the preceding year, TD_{t-1}, can be introduced in the functional equations as explanatory variables.

The same equations as formulated above are valid for the annual demand for telephone connections, ΔD.

In conclusion, we may say that the demand for telephone connections is considered a function of various systematic factors on the basis of which we have formulated the most appropriate functional equations. These equations are tested in linear and curvilinear (exponential) form in the next section.

2.6 The best-fitting regressions

2.6.1 *Total demand for telephone connections*

a) linear form (see table 3);

b) logarithmic form (see table 3b).

2.6.2 *Annual demand for telephone connections*

a) linear form (see table 4a);

b) logarithmic form (see table 4b).

2.7 Analysis of the statistical results

In the preceding section, the best-fitting regressions are given for both total and annual demand. These regression equations explain the changes undergone by the variable under study through the influence of the determinants taken during the period 1958-1968. [7] The equations are in two forms, linear and logarithmic. Comparison of the results obtained with these two forms will show which of them, or even whether both of them, should be selected for forecasting purposes.

We will now attempt a detailed analysis, on the basis of statistical criteria, of the results obtained from the regression equations:

a) the sign of the regression coefficients corresponds to the economic theory on the basis of which the model was formulated;

b) the coefficient of determination, R^2. Most of the regressions have explained more than 95% of the variance of the regressand and the fit of the corresponding lines to the data observed must be considered very good. The average correlation coefficient is found to be about 0.969. In no case is the correlation coefficient below 0.91;

c) the standard error of estimate. On the basis of this criterion, the regression coefficients of the equations tested are statistically significant variables at the level of 5%.

Having analyzed the results obtained, we come to the following conclusions:

1) the regressions tested can be considered to be those which best fit the empirical data concerning the explanatory variables; this can be verified from the coefficient of determination;

2) the forms of the equations can also be considered appropriate, in accordance with the standard error of estimate;

3) the signs of the regression coefficients are indicated by economic theory.

2.8 Elasticity of demand for telephone connections

The demand elasticities with respect to the explanatory variables of the linear equations (both average and partial elasticities have been calculated) are given in table 5.

In the logarithmic form of the regressions applied the elasticity, which is constant during the period in question, is shown in table 6.

Table 5

Demand elasticities of the explanatory variables in the linear equations tried

number of equation	variable	average elasticity	point elasticities				
			1958	1962	1964	1966	1968
	A) elasticity of total demand in linear form						
1	— income Y^r	1.33	1.52	1.50	1.48	1.17	1.23
2	— price P/T	−0.40	−0.54	−0.55	−0.44	−0.30	−0.30
3	— monthly instalment Z	−0.42	−0.54	−0.55	−0.44	−0.30	−0.30
4	— house investment HI	0.84	0.83	0.85	0.99	0.84	0.99
5	— building activity PBA^N	0.85	0.87	0.84	0.98	0.80	0.98
2	— imitation TD_{t-1}	0.53	0.49	0.58	0.52	0.49	0.57
	B) elasticity of annual demand in linear form						
1	— income Y^r	1.90	3.41	2.30	1.82	1.52	1.68
2	— house investment HI	1.19	1.87	1.31	1.22	1.00	1.25
3	— building activity PBA^N	1.20	1.94	1.28	1.20	1.02	1.33
4	— stock kd_{t-1}	−0.57	−0.62	−0.58	−0.52	−0.54	−0.72

Table 6

Demand elasticities of the explanatory variables in the logarithmic equations tried

number of equation	variable	average elasticity	number of equation	variable	average elasticity
1	— income Y^r	1.28	1	— income Y^r	2.07
2	— price P/T	−0.52	2	— house investment HI	1.27
2	— imitation TD_{t-1}	0.72	3	— building activity PBA^N	1.36
3	— monthly instalment Z	0.52	4	— imitation TD_{t-1}	0.35
4	— house investment HI	0.79			
5	— building activity PBA^N	0.85			

▶

3. Demand for telephone calls

3.1 Development of the demand for telephone calls during the period 1958-1968

The demand for telephone calls (automatic, local and long-distance) rose steadily and amounted to 3 billion charging units at the end of the period (1968).

As table 7 shows, local telephone calls increased 402.4% (base year 1958), while long-distance calls increased 222.9%. The percentage distribution of the demand under study between local and long-distance traffic is 72.3% and 27.7% respectively in 1968, compared with 62.6 and 37.4% in 1958. That is to say, the proportion of demand accounted for by local calls followed an upward trend and the proportion of long-distance calls a downward trend in the period 1958-1968. The rate of growth of demand for local telephone calls during the period was 17.5% per annum and 12.4% for long-distance calls. It must be borne in mind that automation of the long-distance service began only in the last years of the period and has not yet been completed. Furthermore, as can be seen from table 7, the number of local telephone charging units in the last four years (1965-1968) showed a considerable increase over that in the earlier years of the period (1958-1964). This means that the need for telephone calls increases with time, mainly owing to the socio-economic development of the country. Moreover, the provision of telephone connections by the Organisation in response to the demand increased considerably and contributed greatly to the growth of demand for telephone calls. Apart from automatic local and long-distance calls, we also have manual and automatic international calls. Table 8 shows the development of this type of call during the period in question.

Table 8 shows that telephone calls to foreign countries, manual and automatic, increased 750% (base year 1958). The average rate of growth of this service was 23.9% during the period. This rising trend in telephone traffic with foreign countries is expected to continue owing to the linking up with the automatic telephone system in foreign capitals, the establishment of operations departments by various shipping offices, the large number of Greek emigrants and the automation of the remaining manual telephone exchanges in the country. For these reasons the rate of increase in manual telephone calls to foreign countries will be reduced.

Table 7

Development of the demand for telephone calls from 1958 to 1968

telephone calls	year						average rate of growth (%)
	1958	1960	1962	1964	1966	1968	
— local	409173	519906	723941	942945	15118283	2055768	17.8
index of change	100	127.1	176.9	230.5	371	502.4	
1:3	62.6	63.6	64.5	63.3	70.3	72.3	
— long-distance	244086	296321	398683	546052	641575	788215	12.5
index of change	100	121.4	163.3	223.7	262.8	322.9	
2:3	37.4	36.4	35.5	36.7	29.7	27.7	
— total calls	653259	816228	1122624	1488998	2159859	2843983	15.8
index of change	100	124.9	171.8	227.9	330.6	435.4	

Source: Statistical Yearbook of Telecommunications, *OTE*, *Athens*, *1969*

Table 8

Development of the demand for international telephone calls during the period 1958-1968

telephone calls	year						average rate of growth (%)
	1958	1960	1962	1964	1966	1968	
— outgoing international calls	28675	66232	87254	227706	275123	243847	23.9
index of change	100	231	304	410	611	850	

Source: OTE, Department of Statistics, Athens, 1969

3.2 Economic factors influencing the development of telephone traffic

Telephone calls are the most important service rendered by the Hellenic Telecommunications Organisation. In this section we shall try to analyze this service statistically by defining its determining factors, quantitative measurement of their effect on demand, etc. Two factors have been selected which exert a considerable influence on the demand for telephone calls; they are national income and the price of the service. So far as national income is concerned, for the reasons mentioned in the analysis of demand for telephone con-

Table 9

Estimate of parameters. Analysis of the statistical results

a) regression equations

number	model	estimate of model	percentage of Y Variance explained by regression (1)	$\bar{R}$ (or $\bar{r}$) (2)	Durbin-Watson d statistic (3)
1*	$TC_t = a + b\ Y_t^r$	$TC_t = -180\ 209 + 3.8330\ Y_t^r$ (0.2369)	96.7	0.983	0.476
2*	$\log TC_t = \log a + b \log Y_t^r$	$\log TC_t = 5.536 + 2.1648 \log Y_t^r$ (0.0564)	99.4	0.997	0.718
3*	$TC_t/N_t^r = a + b\ Y_t^r/N_t^r$	$TC_t/N_t^r = -425.5 + 0.04097\ Y_t^r/N^r$ (0.00268)	96.4	0.982	0.531
4*	$\log TC_t/N'^r_t = \log a + b \log Y_t^r/N_t^r$	$\log TC/N'^r_t = -7.4395 + 2.3281 \log Y_t^r/N_t^r$ (0.0755)	99.1	0.995	0.831
5*	$TC_t = a + b\,PC_t$	$TC_t = -217\ 439 + 3.7808\ C_t$ (0.02250)	97.2	0.986	0.503
6*	$\log TC_t = \log a + b \log PC$	$\log TC_t = -6.894 + 2.4138 \log C_t$ (0.0688)	99.3	0.996	0.981

b) trend equations

number	model	estimate of model	standard error S_Y
1	$TC_i = a + b\,t_i$	$TC_i = 15\ 752 + 23\ 563\ t_i$ (1.987)	208 440
2	$TC_i = a \cdot b\ t_i$ or $\log TC = \log a + t_i \log b$	$TC_i = 55\ 128 + 1.1672\ t_i$ $\log TC = 4.74137 + t_i\, 0.06717$ (0.00139)	56 213

nections, we shall deal with only the urban income. Thus we have:

$$TC_t = f(Y^r) + e_t \qquad (3.2.1)$$

where:

TC = demand for telephone calls

Y^r = urban income

e = residual

t = time.

Functional equation *(3.2.1)* expresses the influence of urban income on the demand for telephone calls. It is tested by the linear and logarithmic forms.

A better explanation of the variable under study will be obtained by eliminating the influence of the " urban population " factor, i.e., by introducing urban *per capita* income in place of urban income in the demand function. Thus we have:

$$TC_t/N_t^r = f(Y_t^r/N_t^r) + e_t \qquad (3.2.3)$$

where:

TC/N^r = *per capita* demand for telephone calls from the urban population of the country

Y^r/N^r = *per capita* urban income.

►

Table 10

Demand elasticities of the explanatory variables in the equations tested

number of model	point elasticities					average elasticities 1958-1968
	1958	1962	1964	1966	1968	
1	3.49	2.55	2.31	1.83	1.50	2.37
2						2.16
3	3.71	2.71	2.48	1.96	1.96	2.31
4						2.33
5	4.10	2.85	2.56	1.96	1.64	2.38
6						2.41

Introducing the price of telephone calls as an explanatory variable in the above functional equation would improve the demand function as regards the number of explanatory variables, but this course is not indicated owing to the constant value of the price during the period under consideration. The demand function *(3.2.1)* can be further investigated. It is known that the development of telephone calls over a long period of time can be interpreted by the fluctuations of two factors, the revenues of the Organisation from this service and its price. Private consumption at constant 1958 prices can therefore be taken as the explanatory variable in the demand function *(3.2.1)* instead of urban income. So we have:

$$TC_t = f(C_i^P)+e_t$$

where:

C^P = private consumption at constant 1958 prices.

The above equation is tested by the linear and logarithmic forms. The coefficient of private consumption indicates that if it rises, the demand for telephone calls will rise proportionately. Whether this variable can be considered an explanatory one in the demand function could be ascertained from the statistical results.

Finally, the demand for telephone connections is investigated from the trend. It is known that the trend incorporates the influence of the changes of all factors, systematic and random. The trend concerned was tentatively introduced into the above functional equations, which meant that the influence of the changes of all the other factors, systematic and random, would be incorporated, except that of urban income or private consumption. This is because the correlation that exists between these two factors—trend and urban income or trend and private consumption—makes it impossible to consider both of them as explanatory variables in the demand function. We therefore decided to examine the trend separately by the arithmetic and geometric straight line method, as follows:

$$TC_t = a+bt_i$$

and

$$TC_t = a+b^{ti}$$

or in logarithmic form:

$$\log TC_t = \log a+t_i \log b$$

Consideration of the best-fitting regressions will be based on the same economic and statistical criteria in the case of telephone connections.

3.3 Analysis of the statistical results

Six regression equations, in linear and logarithmic form, have been calculated in the functions of demand for telephone calls. They can be taken as those which correspond best to the empirical data. The estimate of the parameters of these equations, as for telephone connections, was made by application of the method of least squares. The sign of the regression coefficient of both equations tested is in accordance with the economic theory on the basis of which the model was formulated, i.e. it is positive. The coefficient determination, R^2, can be considered extremely satisfactory for all equations tried. The parameter estimates can be considered statistically significant. Finally, the demand elasticities w.r.t. of each explanatory variable, both average and point elasticities, are included in table 9.

The sign of the demand elasticities is as expected (see table 10); as for the amount, the average elasticities are greater than 1, which means that the demand for telephone calls is over-elastic. Finally, the demand for telephone calls, with regard to time, the standard error was taken into consideration as the criterion of the best-fitting of the lines to empirical data. The results obtained can be considered satisfactory, at a significant level of 5% or less, by using the *t*- student formulae.

4. Forecasts

4.1 Assumptions

The forecasts have been made on certain assumptions with regard to the policy of the enterprise and the factors influencing demand. Policy (e.g. credit policy, price policy, etc.) is assumed to be unchanged in the projected period. The assumptions regarding the exogenous variables concern the expected development in coming years, the appearance of new variables, etc.

The accuracy of the forecasts depends on the realization of the assumptions. To give some idea of the probability that in time the actual course of events will differ from our assumptions, we have made the following list of the assumptions made:

Table 11

Forecast demand for telephone connections and for telephone calls in the projected period 1973-1975

number of model	form	year		
		1973	1974	1975
a) telephone connections (in thousands)				
total demand				
1	linear	550	630	710
2	linear	560	640	730
3	linear	560	640	730
4	linear	530	600	670
5	linear	570	640	730
1	logarithmic	590	680	780
2	logarithmic	610	720	860
3	logarithmic	640	770	920
4	logarithmic	470	520	580
5	logarithmic	530	600	670
annual demand				
1	linear	240	270	320
2	linear	230	260	300
3	linear	250	280	320
4	linear	200	210	220
1	logarithmic	380	480	600
2	logarithmic	270	320	380
3	logarithmic	320	380	460
4	logarithmic	330	410	500
b) telephone calls (in millions)				
1a	linear	630	730	830
1b	logarithmic	970	1250	1600
2a	linear	1.1	1.2	1.4
2b	logarithmic	1.6	2.1	2.5
3a	linear	690	780	900
3b	logarithmic	1250	1550	2000

1. New systematic factors affecting the variable under study will not appear during the projection period.

2. The determining factors defined for the period 1958-1968 will continue to exert the same influence on demand in the forecasting period.

3. The explanatory variables will develop in accordance with our hypotheses.

4. The random factors, which affect the demand irregularly, will be taken into consideration during the projected period as they were in the case of the observed period.

4.2 Evaluation of forecasts

On the basis of these assumptions and the appropriate regressions, the development of the demand for telephone connections and of the demand for telephone calls in the projected period 1973-1975 is forecast as follows:

a) telephone connections (see table 11a);

b) telephone calls (see table 11b).

(Original language: English)

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From the transparent to the clock-controlled data network

by
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SUMMARY

As a result of the growth of remote data processing, further networks transmitting data will in future be set apart from the telex network. These new networks will in many cases be characterized by higher speeds, and frequently also by synchronously working terminals.

The present paper describes how the existing transparent telecommunication networks can be expanded as funds become available to meet these new tasks. In the long run, technological capabilities will lead to digital clock-controlled networks. This change-over has to be made taking into account the economic circumstances of the administrations concerned, such as existing equipment and facilities, and will take a certain length of time, passing through the intermediate stage of hybrid networks. Taking as an example the Siemens EDS system it is shown how a modern data switching system, anticipating the future, provides for the connection of asynchronous and synchronous terminals as well as of frequency- and time-division multiplex systems, both in present-day transparent and in future hybrid and clock-controlled networks.

1. Introduction

In many countries there are large teleprinter networks; more than 500 000 subscribers have so far been connected throughout the world to these networks, which are growing at an annual rate of more than 10% on a world-wide scale. In addition, there are networks for telegram traffic and—with heavily increasing subscriber numbers—for the transmission of data, in particular for remote data processing purposes. All these networks transmit and relay messages, the smallest units of which, called elements or bits, are in binary form (yes/no information or 1/0 states only). In the present paper these networks are collectively called data networks. As will be explained later, there are transparent networks, on the one hand, and clock-controlled networks, on the other, as well as combinations of both.

The subscriber station facilities are matched to the application in question. Telegraph subscribers send and receive the agreed code combinations (characters or bit patterns), in each case controlled by start and stop elements. One therefore speaks of start-stop or asynchronous subscribers. For data traffic it may be of advantage, however, to convey the individual data elements of the characters without start-stop elements. In that case the data stations work in synchronism, the subscribers are therefore called synchronous subscribers. All the subscriber facilities are connected to the network through standard interfaces (in the case of public networks and for certain leased circuits agreed upon internationally by recommendations of the International Telegraph and Telephone Consultative Committee — CCITT), independently of the internal characteristics of the network. The present paper is to show, in the light of such examples as the modern electronic data switching system (*EDS*), how these standard interfaces lead from existing transparent networks to clock-controlled networks as funds become available. To begin with, the characteristic features of the various types of data network will be described in some detail.

2. Characteristic features of data networks

2.1 The transparent network

In a transparent network each polarity reversal is switched through in each transmission section and in each exchange at the time of its occurrence, i.e. independently of the time interval between the individual reversals (figure 1a). The network is thus speed-transparent. After each transmission section, the signal elements received are demodulated; their edge steepness, in some cases also the signal element length, is restored, and the signal elements are—after passing an exchange and renewed modulation if the case arises—retransmitted. While the proven frequency-division multiplex systems have mainly been employed for transmission so far, the modern time-division multiplex systems can also be used for transparent networks. It is even possible to use one or the other type of system on individual transmission sections, according to technical and economic conditions. Thus a large measure of flexibility is provided in the actual layout of transparent data networks.

2.2 The clock-controlled network

If time-division multiplex systems are used on all transmission sections, it will be of advantage in many cases not only to transmit the messages within the network under clock control, but also to switch them under clock control (figure 1b). As a result, the efficiency of the network can frequently be increased considerably. Using multi-phase transmission methods, data signals with more than two states

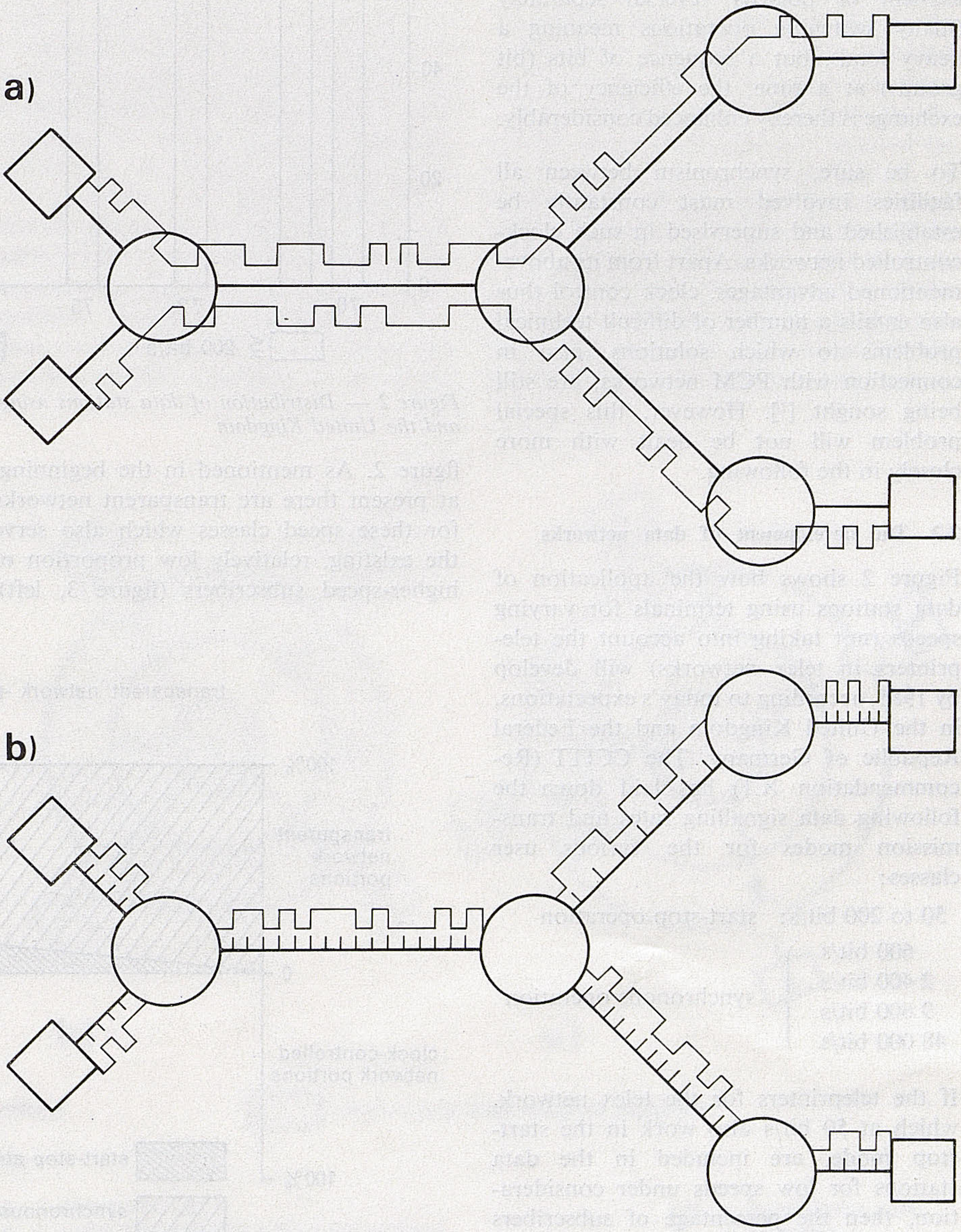


Figure 1 — Types of data networks
a) *transparent network;* b) *clock-controlled network*

can be conveyed on the transmission sections. In four-phase (quarternary) differential modulation, for example, the four possible states of a 2-bit group (" 00 ", " 01 ", " 10 ", " 11 ") are transmitted by the three phase shifts (+90°, −90°, 180°) of a carrier wave and the fourth " no vector shift " criterion. As a result, the modulation rate within a certain bandwidth is increased considerably, the transmission paths are utilized particularly well. If the switching system does not process or switch through each signal element or polarity reversal separately (many switching operations meaning a heavy load), but a sequence of bits (bit groups) at a time, the efficiency of the exchange is thereby enhanced considerably.

To be sure, synchronism between all facilities involved must constantly be established and supervised in such clock-controlled networks. Apart from its abovementioned advantages, clock control thus also entails a number of difficult technical problems to which solutions, also in connection with PCM networks, are still being sought [1]. However, this special problem will not be dealt with more closely in the following.

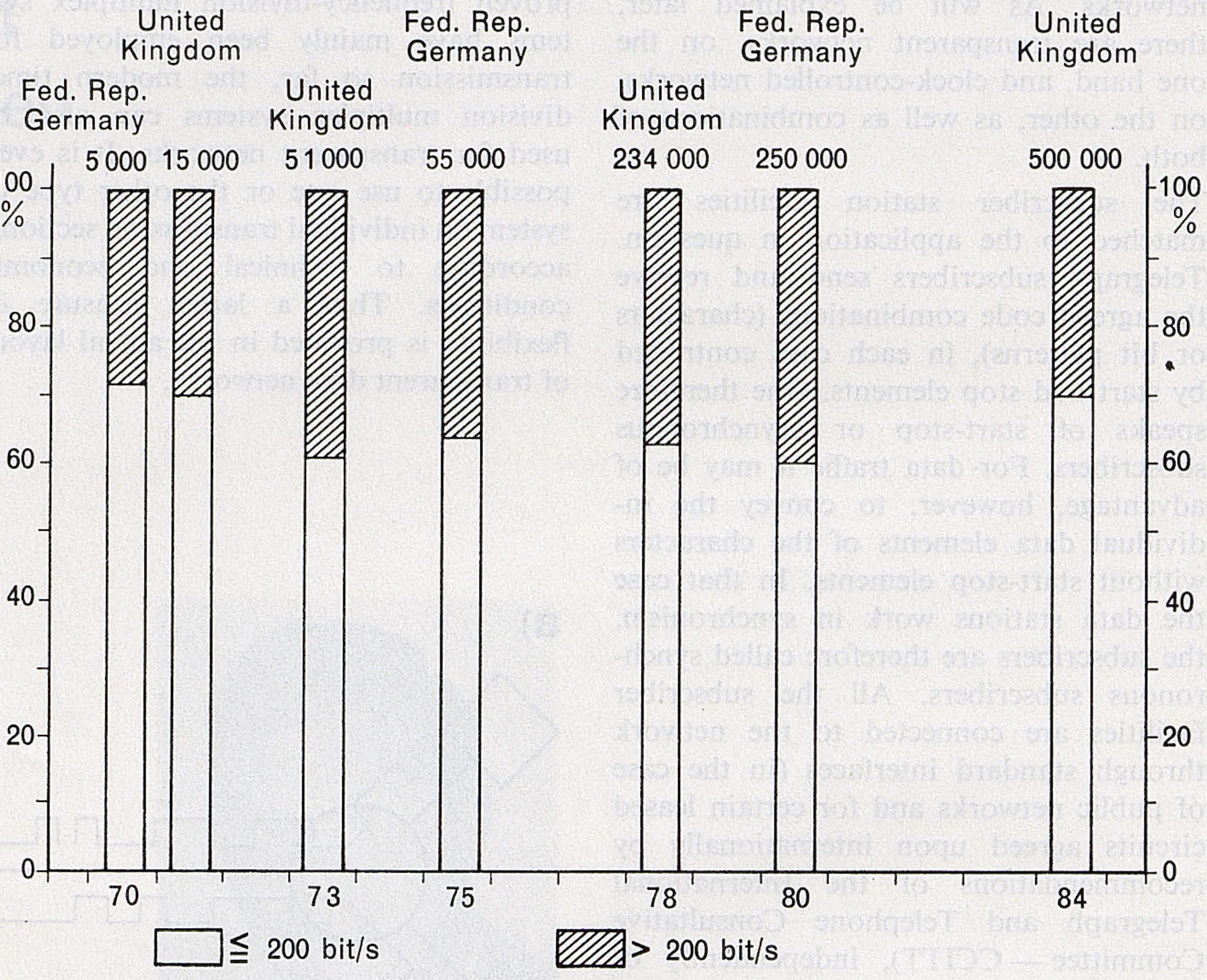


Figure 2 — Distribution of data stations using various speeds in the Federal Republic of Germany and the United Kingdom

2.3 The development of data networks

Figure 2 shows how the application of data stations using terminals for varying speeds (not taking into account the teleprinters in telex networks) will develop by 1985, according to today's expectations, in the United Kingdom and the Federal Republic of Germany. The CCITT (Recommendation X.1) has laid down the following data signalling rates and transmission modes for the various user classes:

50 to 200 bit/s: start-stop operation

600 bit/s
2 400 bit/s
9 600 bit/s
48 000 bit/s
} synchronous operation

If the teleprinters for the telex network, which at 50 bit/s also work in the start-stop mode, are included in the data stations for low speeds under consideration, then the percentage of subscribers in the speed ranges up to 200 bit/s is appreciably larger than indicated in figure 2. As mentioned in the beginning, at present there are transparent networks for these speed classes which also serve the existing, relatively low proportion of higher-speed subscribers (figure 3, left).

In the course of time these networks will be supplemented on a regional level by clock-controlled network portions to accommodate, for example, the synchronous subscribers (figure 3, centre). In this way

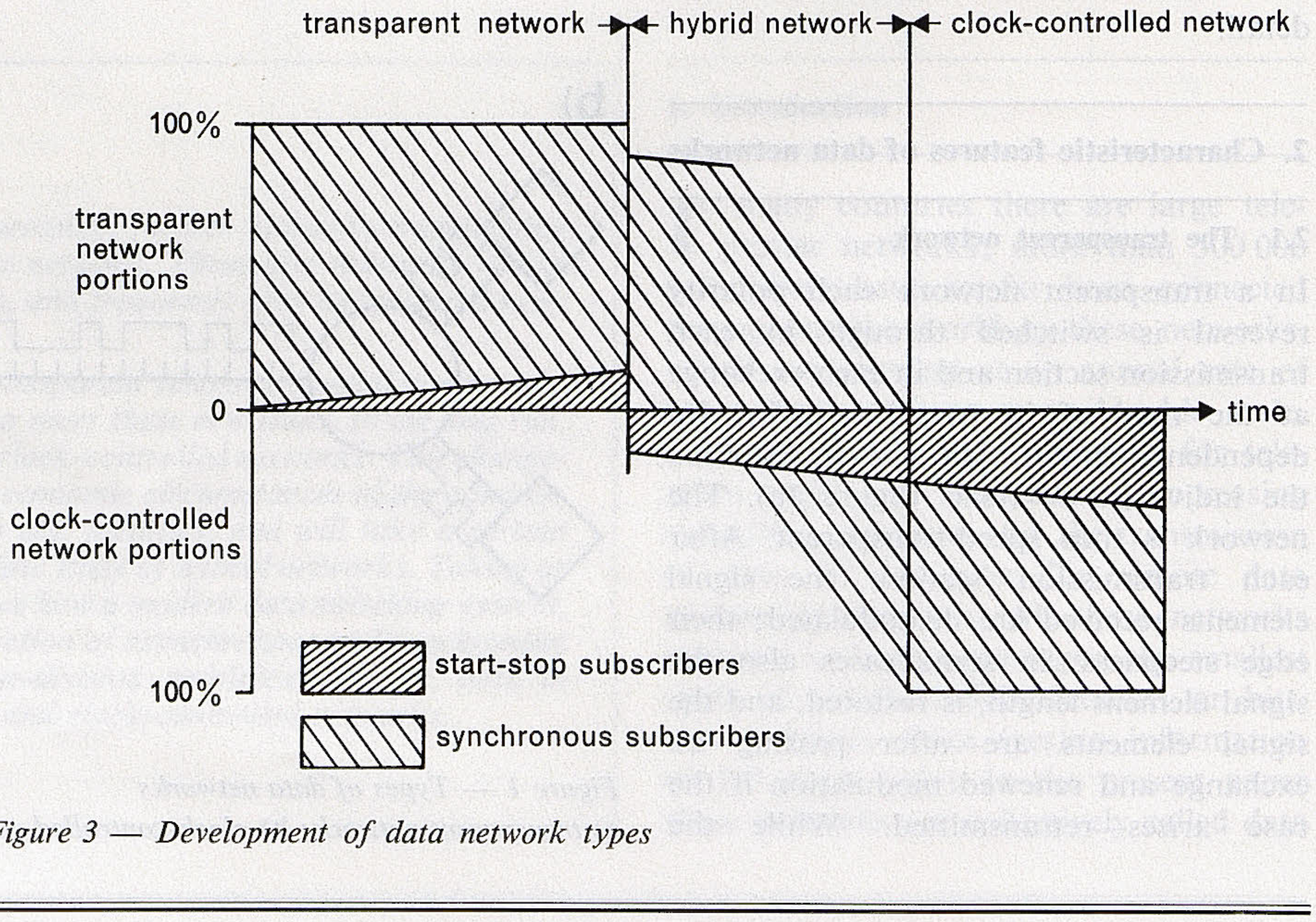


Figure 3 — Development of data network types

hybrid networks are created. By and by they can be converted as required into completely clock-controlled networks, which will then handle, in addition to the synchronous subscribers, a still considerable proportion of start-stop subscriber traffic (figure 3, right). However, this development from the transparent network, by way of hybrid networks, to the clock-controlled network will be affected not only by technical capabilities, but also to a very great extent by economic conditions (existing equipment and facilities, funds available for financing purposes, etc.) and will probably take several decades.

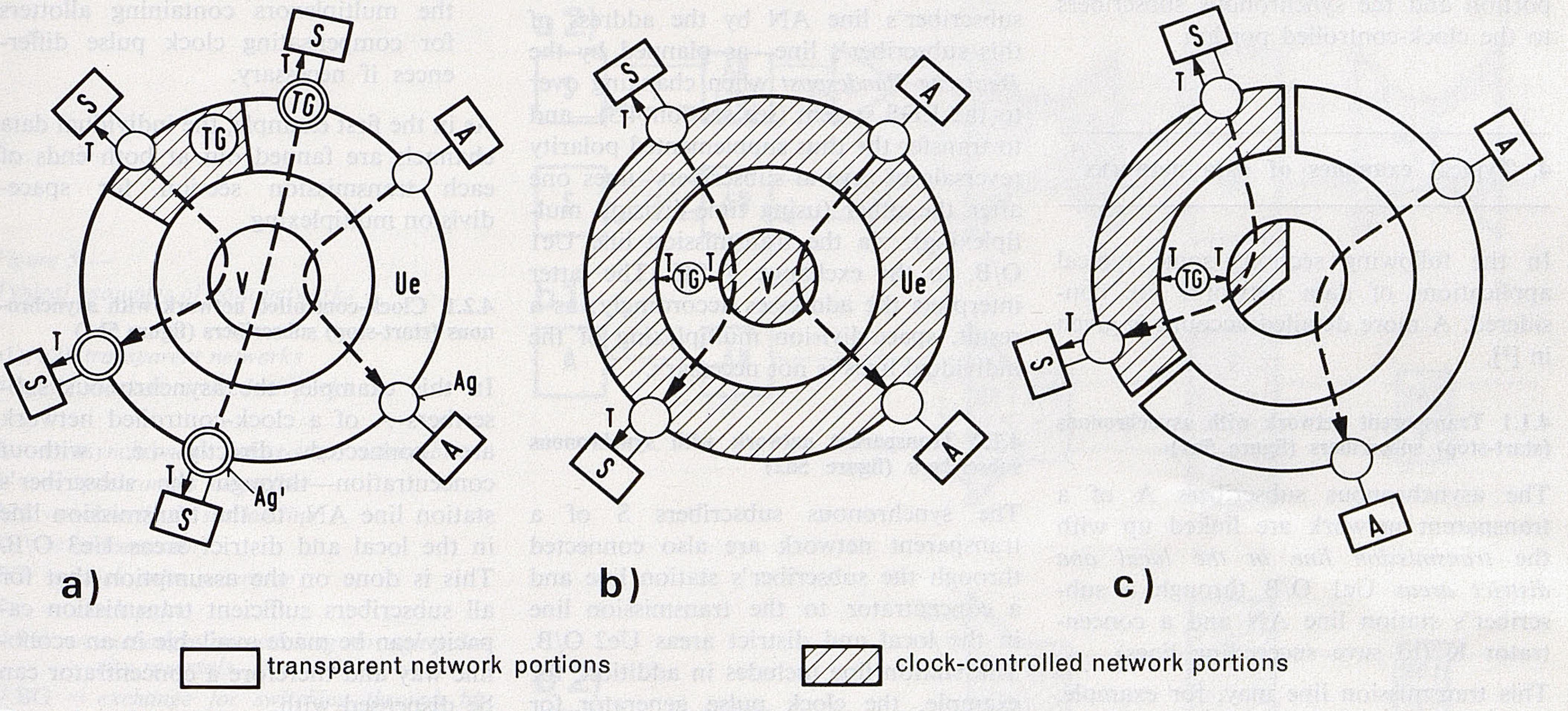
3. The basic configuration of data networks

3.1 The transparent network

Such networks (figure 4 a) consist of exchanges V, which are speed-transparent, transmission paths Ue, largely (frequency-division multiplex systems) without and partly (time-division multiplex systems) with internal clock control, and the subscribers with their connecting units Ag at the periphery. The data of the asynchronous subscribers A are transmitted and relayed by the network without further measures on a speed-transparent basis. Synchronous subscribers S can also communicate in this network, but as a rule (as in the case of dedicated circuits) they require clock pulse T from the network. For these subscribers, the peripheral connecting units are therefore equipped with a clock pulse generator TG. If clock-controlled transmission paths are available (time-division multiplex circuits, such as in figure 4 a, top left), the clock pulse of these time-division multiplex facilities can be used instead of a separate clock pulse generator. To ensure that synchronism is maintained for transmission of steady " 0 " or steady " 1 " and that the transmitting power is distributed over the entire width of the frequency band of the transmission circuit if necessary, special facilities, so-called scramblers, in the connecting units at the transmitting end generate polarity reversals on the transmission circuit at a constant frequency. At the receiving end, the clock pulse for controlling the synchronous subscribers is derived from these polarity reversals; in addition, special facilities—so-called de-scramblers—restore the original form of the bit patterns.

3.2 The clock-controlled network (figure 4b)

In the clock-controlled network, the transmission paths and exchange, for example, are controlled in common by a clock pulse generator, which furnishes the clock pulse used to this end also to the synchronous subscribers. The scramblers and de-scramblers provided in the transparent network can in that case be dispensed with, unless they are required for reasons of even power distribution on the transmission circuit. Data between start-stop subscribers can also be transmitted in this network. But since in this case the polarity reversals are independent of the network clock pulse, their integration into the clock-controlled bit stream of the network results in certain timing errors.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S
A
b)
S
T
A
T
T
TG
T
S
A
c)
transparent network portions
clock-controlled network portions

Figure 4 — Schematic representation of data networks

a) *transparent network*
b) *clock-controlled network*
c) *hybrid network*

Ag = *connecting unit*
Ag′ = *connecting unit with clock pulse recovery*
A = *asynchronous (start-stop) subscriber*
S = *synchronous subscriber*

Ue = *transmission paths*
V = *exchange*
TG = *clock pulse generator*
T = *clock pulse*

▶

These errors can, however, be kept within tolerable limits either by sampling at sufficiently short time intervals (e.g., 20 sampling actions per 50-baud signal element will produce a maximum timing error of 5%) or by transmitting each (data signal) polarity reversal with, for example, several timing bits in the bit stream of the network. One of these bits identifies the state ("0" or "1") after a polarity reversal. The other bits indicate at what period of the bit concerned in the bit stream of the network the (data signal) polarity reversal was transferred to the network for transmission (5 bits will result in a timing error of about 4% in 50-baud telex transmission).

3.3 The hybrid network (figure 4c)

The hybrid network is a combination of the transparent and the clock-controlled network. It therefore contains a transparent and a clock-controlled network portion. The data between the various subscribers are transmitted as described for the transparent and the clock-controlled networks. In the present example (figure 4c), the asynchronous subscribers are connected to the transparent network portion and the synchronous subscribers to the clock-controlled portion.

4. Typical examples of data networks

In the following sections some typical applications of data networks are considered. A more detailed account is given in [2].

4.1.1 Transparent network with asynchronous (start-stop) subscribers (figure 5a1)

The asynchronous subscribers A of a transparent network are linked up with the *transmission line in the local ana district areas* Ue1 O/B through a subscriber's station line AN and a concentrator K (to save succeeding lines).

This transmission line may, for example, consist of:

- a frequency-division multiplex system (voice-frequency telegraph (VFT) terminal) on a voice channel;
- a time-division multiplex system over a PCM circuit;
- a time-division multiplex system over LF cable;
- a time-division multiplex system over a carrier channel or carrier channel group.

It is followed by the exchange V SU switching through the individual polarity reversals as they occur, and finally, the transmission line in the long-distance area Ue1 F.

Like the line Ue1 O/B, the transmission line in the long-distance area alternatively consists of:

- a voice channel using VFT equipment;
- a PCM circuit using time-division multiplex equipment;
- a carrier channel group using time-division multiplex equipment.

In this example, space-division multiplexing into the various data channels is thus effected at both ends of each transmission section. There are, of course, other possibilities. Thus it may be advantageous, for example, to supplement each polarity reversal arriving from the subscriber's line AN by the address of this subscriber's line—as planned by the *Deutsche Bundespost* when changing over to the EDS system (see section 4.3)—and to transfer the thus supplemented polarity reversals of several subscribers' lines one after the other (using time-division multiplexing), via the transmission line Ue1 O/B, to the exchange V SU. The latter interprets the addresses accordingly; as a result, space-division multiplexing of the individual lines is not necessary.

4.1.2 Transparent network with synchronous subscribers (figure 5a2)

The synchronous subscribers S of a transparent network are also connected through the subscriber's station line and a concentrator to the transmission line in the local and district areas Ue2 O/B. The station line includes in addition, for example, the clock pulse generator for synchronous operation and the scrambler and de-scrambler.

On account of the higher modulation rate, the transmission line consists in this case:

- of a carrier channel group with data converters whose operation resembles that of VFT channels, or
- of time-division multiplex equipment as specified for the connection of asynchronous subscribers. The multiplexors incorporate allotters which compensate for the differences in clock pulse of the subscribers and transmission section. It is also possible to switch through the clock pulse from the clock pulse generators of the multiplexors, by way of the subscriber's station line, to the subscriber (figure 5a2, bottom). In that case the allotters in the multiplexors can be dropped.

The transmission line Ue2 O/B is then again followed by the exchange V SU (for through-connection of polarity reversals) and the transmission line Ue2 F in the long-distance area.

Like line Ue2 O/B, the long-distance transmission line consists of:

- a carrier channel group with data converters, or
- the time-division multiplex equipment described for asynchronous operation, the multiplexors containing allotters for compensating clock pulse differences if necessary.

As in the first example, the individual data channels are fanned out at both ends of each transmission section for space-division multiplexing.

4.2.1 Clock-controlled network with asynchronous (start-stop) subscribers (figure 5b1)

In this example, the asynchronous subscribers A of a clock-controlled network are connected directly—i.e. without concentration—through the subscriber's station line AN, to the transmission line in the local and district areas Ue3 O/B. This is done on the assumption that for all subscribers sufficient transmission capacity can be made available in an economic way and therefore a concentrator can be dispensed with.

The transmission circuit Ue3 O/B is equipped with a multiplexor on the subscriber's station line side only and thus consists of this multiplexor and:

- a time-division multiplex (PCM) circuit, or
- an LF cable with data transmission equipment or,
- a carrier channel group with data transmission equipment.

At the exchange end, the individual data channels are always connected in common for time-division multiplexing. The exchange V BG provides for spatial allocation between offering and serving lines and also for the correctly timed allocation of the individual data channels within the multiplex lines. In this arrangement the multiplexors in the exchanges are therefore generally dispensable. The exchange invariably switches through bit groups.

The exchange is followed by the transmission line Ue3 F in the long-distance area. It consists of:

- a time-division multiplex (PCM) circuit, or
- a carrier channel group with data transmission equipment.

The transmission circuits and exchange use the same network clock pulse. But it is also possible to form " clock pulse islands ", each with a separate system clock pulse, from various exchanges and the transmission paths connected thereto. Present-day technical means (crystal- or atomic-clock controlled timing pulse generators) ensure that practically no clock pulse deviations occur between the clock pulse islands and, as a result, the network uses a quasi-uniform clock pulse. This is called plesiochronous operation. This case is represented in the figure by the absence of a clock pulse between the exchange V BG and the transmission line in the long-distance area Ue3 F.

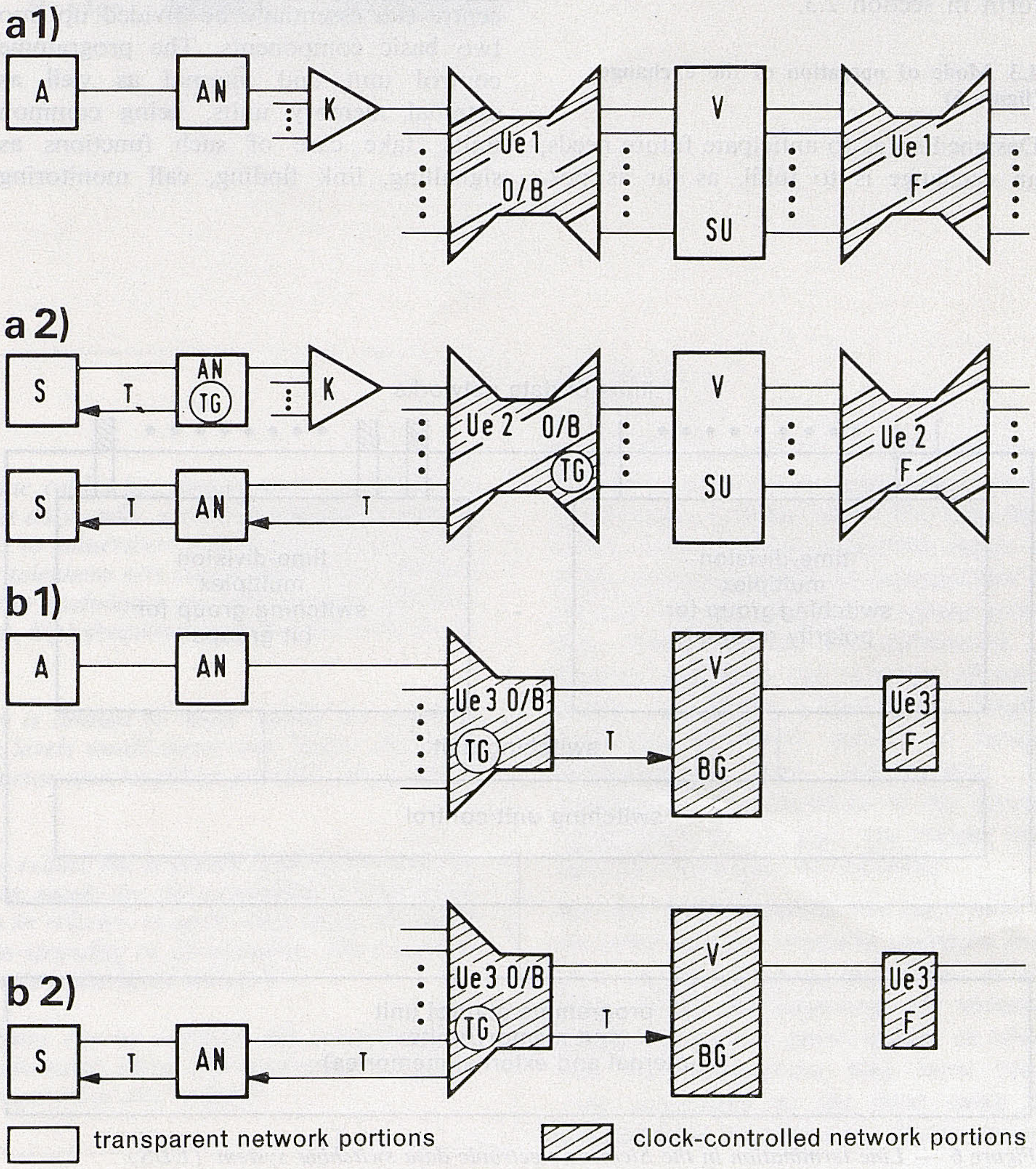

Figure 5 — Typical examples of data networks

a1), a2) *transparent networks*
b1), b2) *clock-controlled networks*

A = *asynchronous (start-stop) subscriber*
S = *synchronous subscriber*
AN = *subscriber's station line*
K = *concentrator*
TG = *clock pulse generator*
T = *clock pulse*
V SU = *exchange for switching through polarity reversals*
V BG = *exchange for switching through bit groups*
Ue 1 . . . 3 O/B = *transmission circuit (local and district areas)*
Ue 1 . . . 3 F = *transmission circuit (long-distance area)*

▶

4.2.2 Clock-controlled network with synchronous subscribers (figure 5b2)

The connection of synchronously working subscribers of a clock-controlled network and the configuration of this network correspond to the connection of asynchronous subscribers to a clock-controlled network and its configuration. The only difference is that the synchronous subscribers are also fed the network clock pulse via the subscriber's station line. As mentioned already, it must not be overlooked, in view of the potentialities of clock-controlled data networks, that the establishment, maintenance and control of synchronism within the entire network require a great engineering effort. Over and above this, the changeover to clock-controlled networks will be strongly influenced by economic conditions, as set forth in section 2.3.

4.3 Mode of operation of the exchanges (figure 6)

Designed so as to anticipate future needs, an exchange is to fulfil, as far as possible, all tasks resulting from the above-described present and future types of network.

Following is a description of how a modern data switching system, the EDS, solves the previously outlined problem, i.e. asynchronous and synchronous subscribers connected in transparent, hybrid and future clock-controlled networks. The EDS system, which, moreover, integrates several data networks using different speeds, for example, into *one* switching system, has been described in detail elsewhere [3-6]. Here only the characteristic features of this switching system when switching through data in transparent and clock-controlled networks will be dealt with in some detail.

Disregarding the modular redundancy structure of the system, an EDS switching centre can essentially be divided up into two basic components. The programme control unit and internal as well as external memory units, being common units, take care of such functions as signalling, link finding, call monitoring and subscriber service routines. Connected ahead of these units in the direction of the data lines is the switching unit for switching through the data between the interconnected channels of the various data networks. During call setup and cleardown, this switching unit exchanges dial information and signalling criteria between the lines and the common units.

When the call has been set up, the incoming information—polarity reversals or bit groups—is offered together with the offering-line address. This offering-line address identifies the offering line and, in a time-division multiplex system, also the time-division channel. The switching unit control finds the serving-line address in the relevant offering cell of the memory unit or in a high-speed memory located in the switching unit. With the aid of the serving-line address, the information is despatched, i.e. transferred to the outgoing line and the outgoing time-division channel, if the case arises.

(Original language: English)

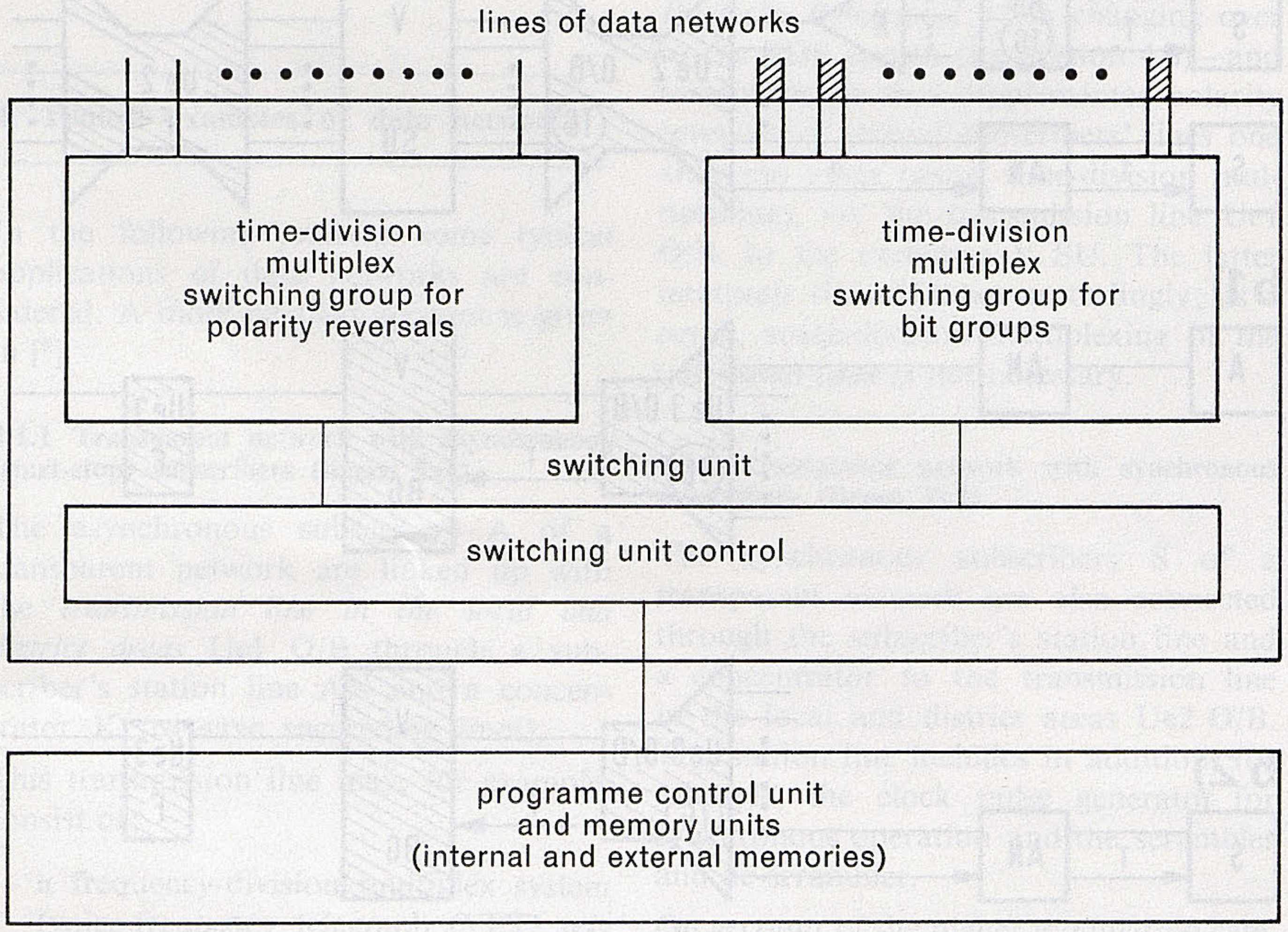
lines of data networks
time-division multiplex switching group for polarity reversals
time-division multiplex switching group for bit groups
switching unit
switching unit control
programme control unit and memory units (internal and external memories)

Figure 6 — Line termination in the Siemens electronic data switching system (EDS)

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Cross-stranding of telephone cables

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Sweden

SUMMARY

The crosstalk level of symmetrical telephone cables has always been considered of importance. Today this is even more so, not only under special conditions in certain trunk cables, but also in distribution cables to subscribers and to other parts of the network. One reason for this is that today telephone sets can be made more efficient at a reasonable cost by using semiconductor techniques as well as more effective materials in their various components. Also, high-frequency systems are used to an increasing degreee.

Today the effectiveness of a telephone set is limited to some extent by existing crosstalk levels. An improvement of these levels would mean that longer distances could be spanned and a reduction of conductor size would be possible, all of which opens up interesting economic prospects.

The purpose of the idea presented here is to reduce the crosstalk level by introducing a new cabling technique, where the pairs or quads are not assembled in concentric layers but repeatedly change their position in relation to each other along the cable length. We have named this technique cross-stranding or X-stranding. The excessive build-up of couplings between discrete circuits is therefore reduced.

This improvement in electrical characteristics can be realized with manufacturing equipment that has lower investment and operating costs. The equipment is characterized by its simplicity. The floor space required is also reduced.

Introduction

Efforts to improve the crosstalk level have up to now been concentrated on the pair or quad itself. The very first cables were made of concentric layers of single conductors and the introduction of the pair was the first step to reduce crosstalk. There followed the elaboration of theories regarding the relation of pitch length. Randomly varied pitch lengths were also proposed. Efforts to further improvements were concentrated on achieving closer tolerances of the various components of the pair, the copper wire and the insulation, for example.

But very little attention has been paid to the effect that the *stranding operation* may have on the electrical properties of the cable. From the beginning, the elements (single conductors, pairs, quads, or whatever the components may have been) were assembled in the final cable by placing them in concentric layers around

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a centre element. In each layer the components run in parallel and adjacent to one another for the full length of the cable. Somewhat later the unit was introduced, the complete cable consisting of a number of such units, which in themselves are small cables consisting of a fixed number of elements such as 10, 25, 50 or 100 pairs, etc. But this unit is still built up in concentric layers. The method seems to be a copy of the wire rope technique. But—does it necessarily correspond to the demands of a telephone transmission system?

It is quite natural that crosstalk between two pairs occurs when they are close to each other. It is also evident that the crosstalk will be higher when they are in close proximity for a long distance. In the conventional layer stranding technique, the pairs are running adjacent, as *close as possible to each other*, *all along the total cable length*. There are also combinations of pairs, constantly separated, with very good crosstalk levels. But, in a telephone system, the worst values very often are limiting, and it does not help if some of values only are very good ones.

In fact, the stranding system used today can be considered as the least favourable when related to required crosstalk properties. Any other, where pairs can be more widely separated, corresponds better to transmission demands.

The concentric layer system also introduces systematic irregularity. It is well known that the mutual capacitance of pairs have different levels in different layers, which also applies to the pairs in the centre, giving systematic differences in the propagation of the signal. In this case also the layer technique is less favourable.

Therefore in addition to efforts to improve the quality of the elements, pairs, quads, etc., the introduction of another stranding technique is of interest.

The principle of the new cabling technique

According to the crosstalk theory, the capacitance unbalance between two pairs is the dominant factor, at least at low frequency. If we look at a conventional cable of 10 or 20 pairs, as in figure 1, it is well known that unbalances occur mainly between adjacent pairs and also to some extent between the centre element and the elements in the first layer. Between other combinations the unbalance is negligible. It is also known that the highest unbalances in a cable increase in direct proportion to the length.

If we now consider the upper pair in figure 1 a), the 10-pair group, and let all other 9 pairs repeatedly change position in relation to this special pair along the cable, then any other arbitrarily chosen pair will have an adjacent position only for a fraction of the total cable length.

The arbitrary pair can have nine positions in relation to the pair under consideration, but of these only two are really adjacent and two other positions, in the centre, may be said to be adjacent. Since capacitive coupling only occurs when pairs are adjacent, unbalances are built up on only 4/9ths of the cable length, with corresponding reduction in the unbalances.

The principle of reduction in capacitance unbalance in a cable network installation has long been used in the operation of splicing the different cable lengths. By that method, pairs in one length are chosen at random and spliced to the other length so that two adjacent pairs in one length are not necessarily spliced to the adjacent pairs in the next. In that case, the unbalance built up in one cable length is very unlikely to be added to a corresponding high value in the following length. It can be said that the method of reduction of excessive unbalances by random *splicing* has been substituted by prefabricated mixing. If random splicing has been considered positive in avoiding the build-up of high crosstalk values, then this method must also be considered as positive and to an even higher degree, since the mixing is made on very short lengths, whereas the build-up on whole-delivery conventional lengths can be

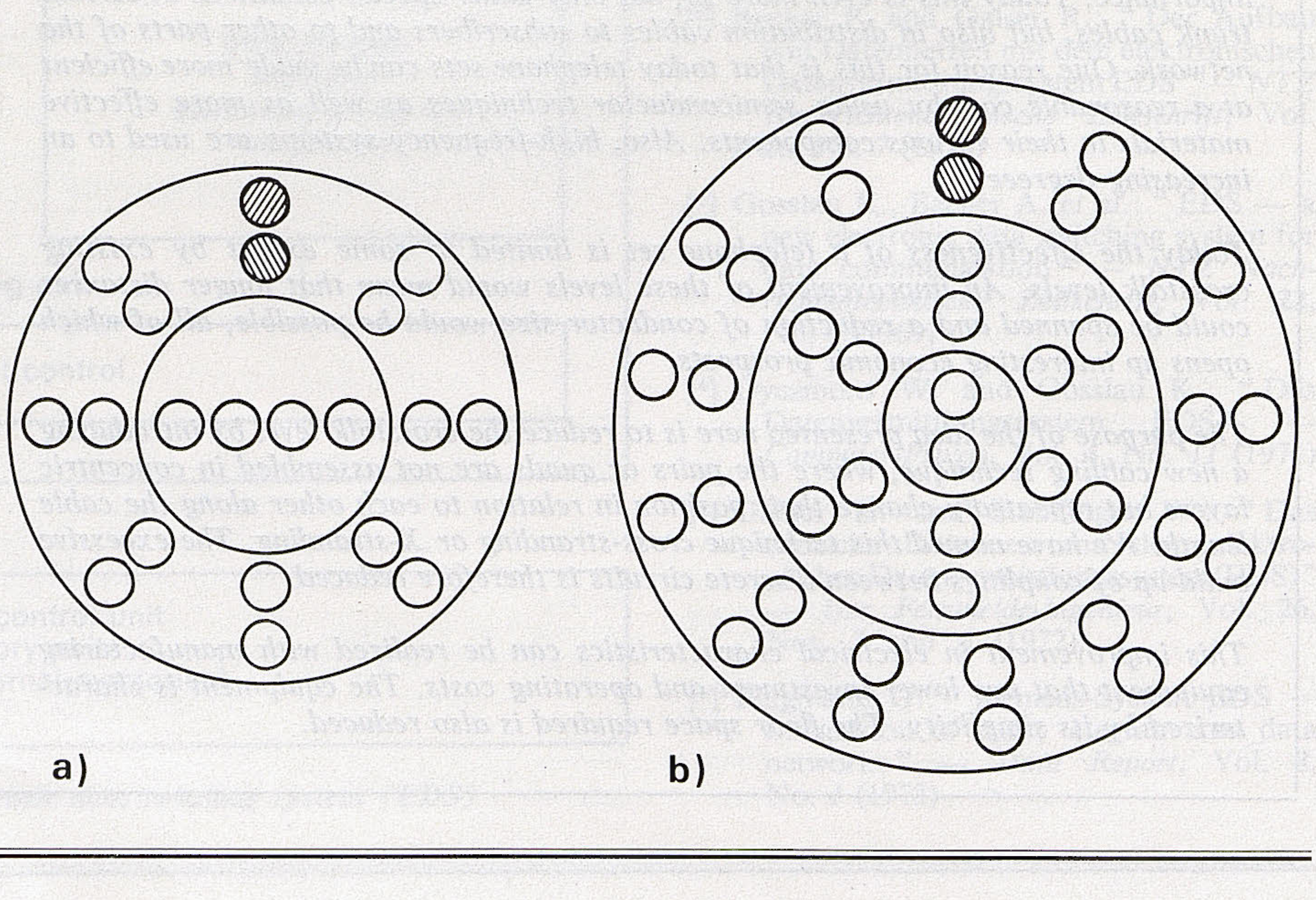


Figure 1 — Conventional cable
a) *10 pairs;* b) *20 pairs*

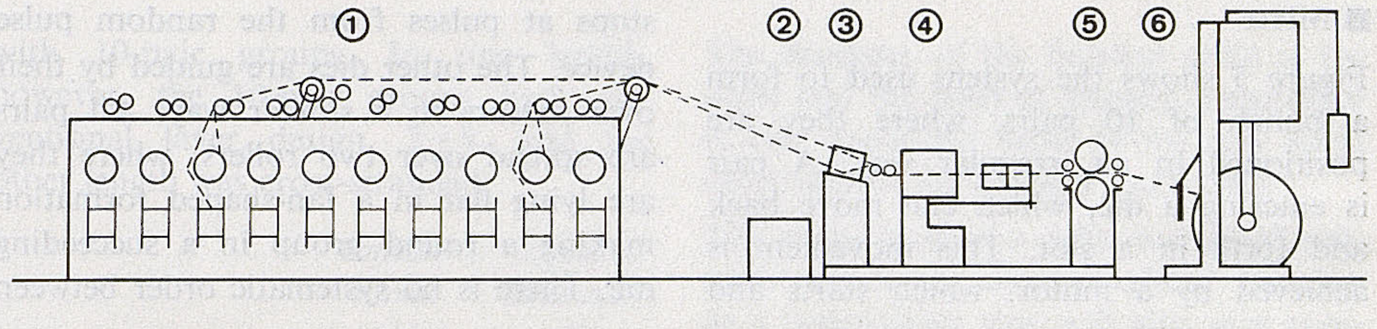


Figure 2 — Twinning and assembling machine

1. *Twinner unit*
2. *Random pulse generator*
3. *Mixer*
4. *Binder head*
5. *Length measuring device*
6. *Take-up unit*

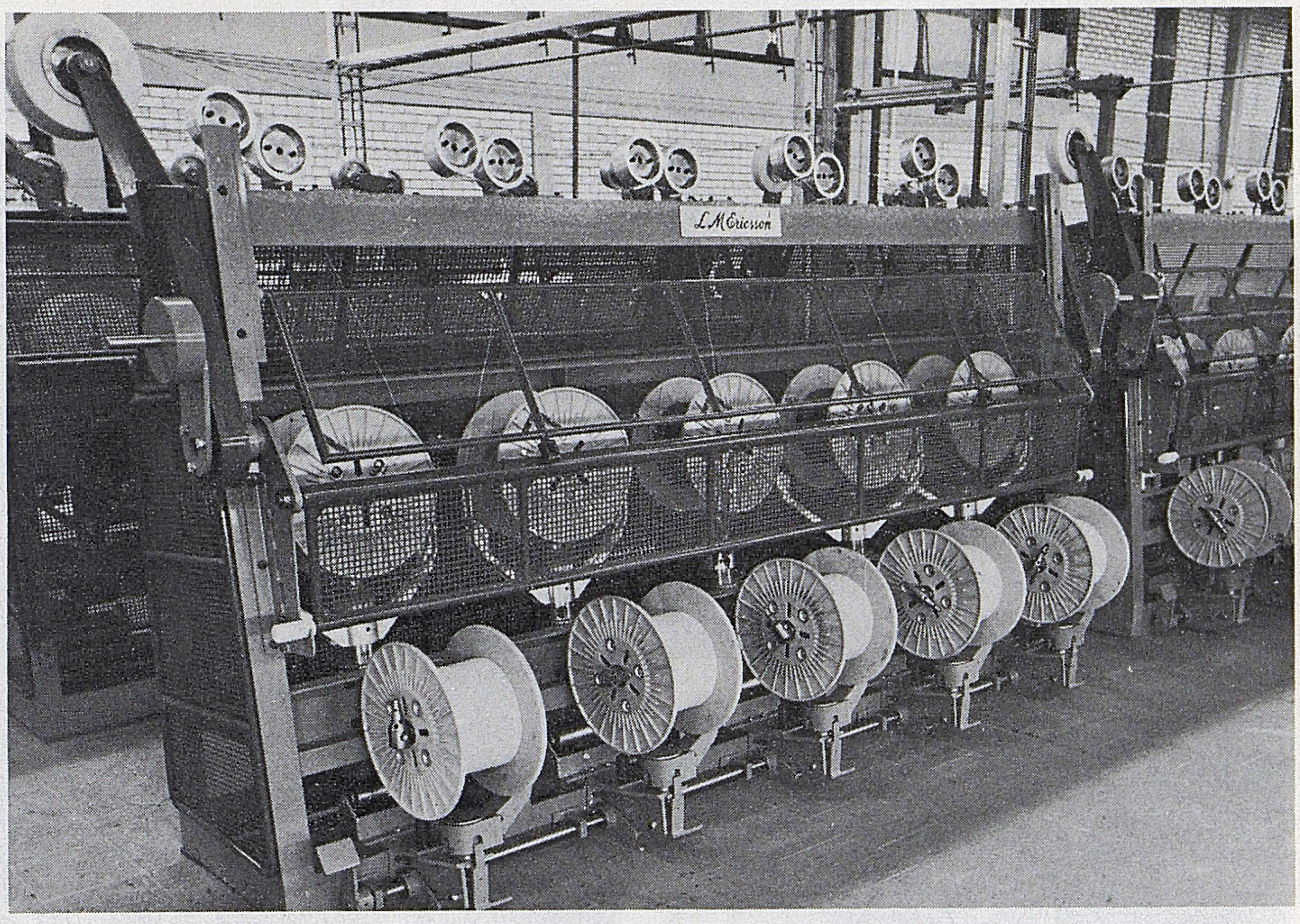


Figure 3 — Twinner unit

considerable and will never be eliminated by random splicing.

It is evident that the mixing of pairs in a bigger group will give an even better result. If we study the 20-pair group in figure 1 b) we find that a pair will be adjacent to another arbitrary pair, repeatedly taking different positions in the cable at a length of 3/19ths of the total cable length, and a corresponding reduction can be expected. However, this calculated reduction, both concerning the 10-pair and 20-pair groups, is only approximate. The tendency is that the mixing of an increasing number of pairs will reduce the unbalances correspondingly. In a 100-pair unit, for instance, the resulting unbalances would barely reach measurable values. On the other hand, a 10-pair group may be considered as the smallest in which this method will give reasonable results. Considering the demands of a suitable colour coding system, and for other practical reasons, the method seems suitable for groups from 10 pairs up to about 30 pairs.

As already mentioned, the stranding operation differs from that hitherto used. The pairs, or elements, of whatever shape, are assembled in a unit, at present 10-pair groups, with the elements repeatedly changing their relative positions. This can be done in different patterns. One would be, for example, where the pairs are moved within the group according to a predetermined systematic pattern. This could have the possible disadvantage that two pairs will meet each other at fixed intervals, where the crosstalk occurs. At high frequency transmission this will happen at discrete frequencies, corresponding to a wavelength equal to the length of the intervals.

Another method, which is described here, has the mixing points distributed at random distances, thus overcoming this disadvantage.

In both cases, the mixing of the pairs also gives a certain flexibility to the unit and could in this respect be compared to the braiding operation of the outer conductor of a flexible coaxial cable.

Production methods

Since we are operating with a fixed unit, in our case a 10-pair group, it is advantageous to make the twinning of such a small number of pairs in the same operation as the assembling of the group. Therefore the machine consists of the following parts (see figure 2):

1. Twinner unit.
2. Random pulse generator.
3. Mixer.
4. Binder head.
5. Length measuring device.
6. Take-up unit.

■ Twinner unit

The ten twinning heads are assembled in one unit (figure 3). Since the forming of a pair is, in itself, a simple operation we have tried to make the machine correspondingly simple. An added advantage is that the machine in operation is almost noiseless.

■ Random pulse generator

This device (see figure 4) gives pulses to the mixing unit and is of electronic design, using the noise spectrum of a transistor as its basis.

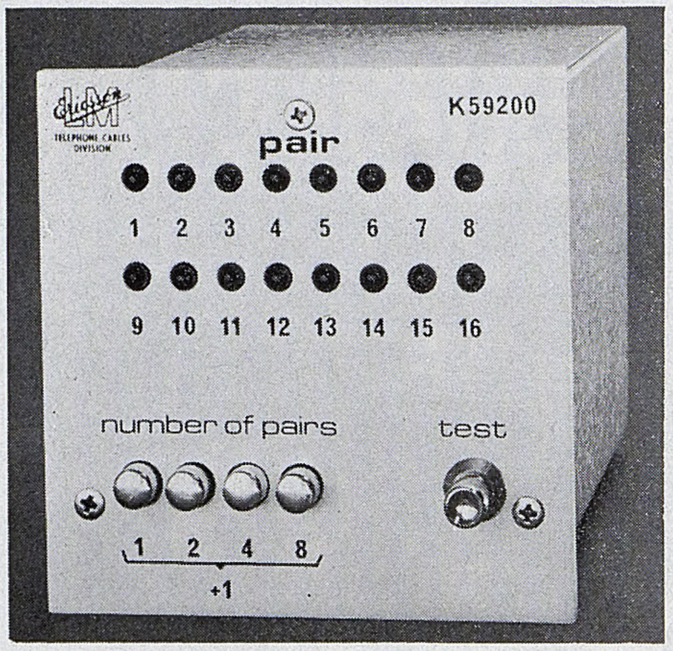
►

■ Mixer

Figure 5 shows the system used to form a bunch of 10 pairs, where they are positioned in an irregular way. A pair is entering a die, which can move back and forth in a slot. This movement is achieved by a motor, which starts and stops at pulses from the random pulse device. The other dies are guided by their own motors in a similar way. All pairs are spread over two rollers, where they are lying flat in a fan-shaped formation making a round group in a succeeding die. There is no systematic order between the pairs, and they repeatedly change position on the roller during the manufacture of the cable.

■ Binder head

After the assembling die comes a binder (figure 6), which keeps the pairs in the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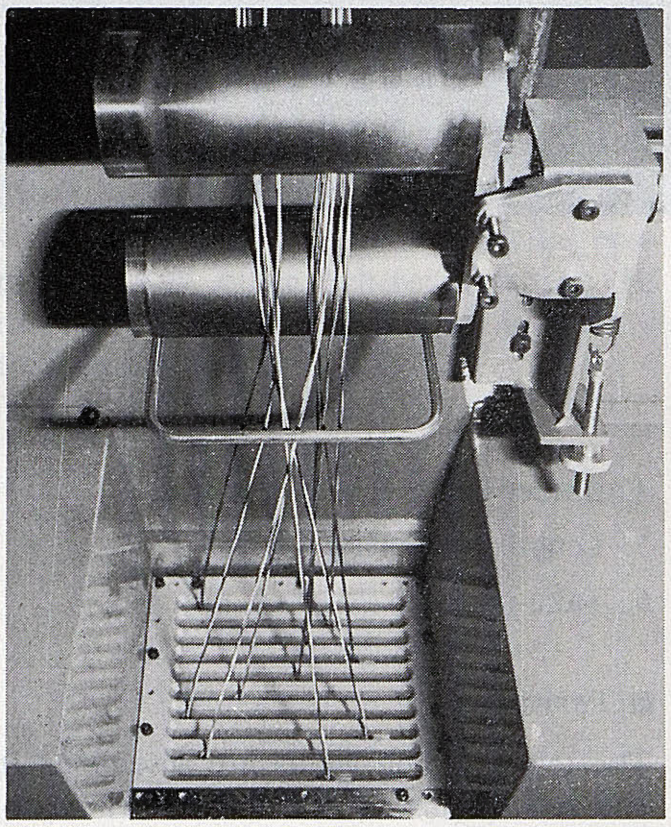

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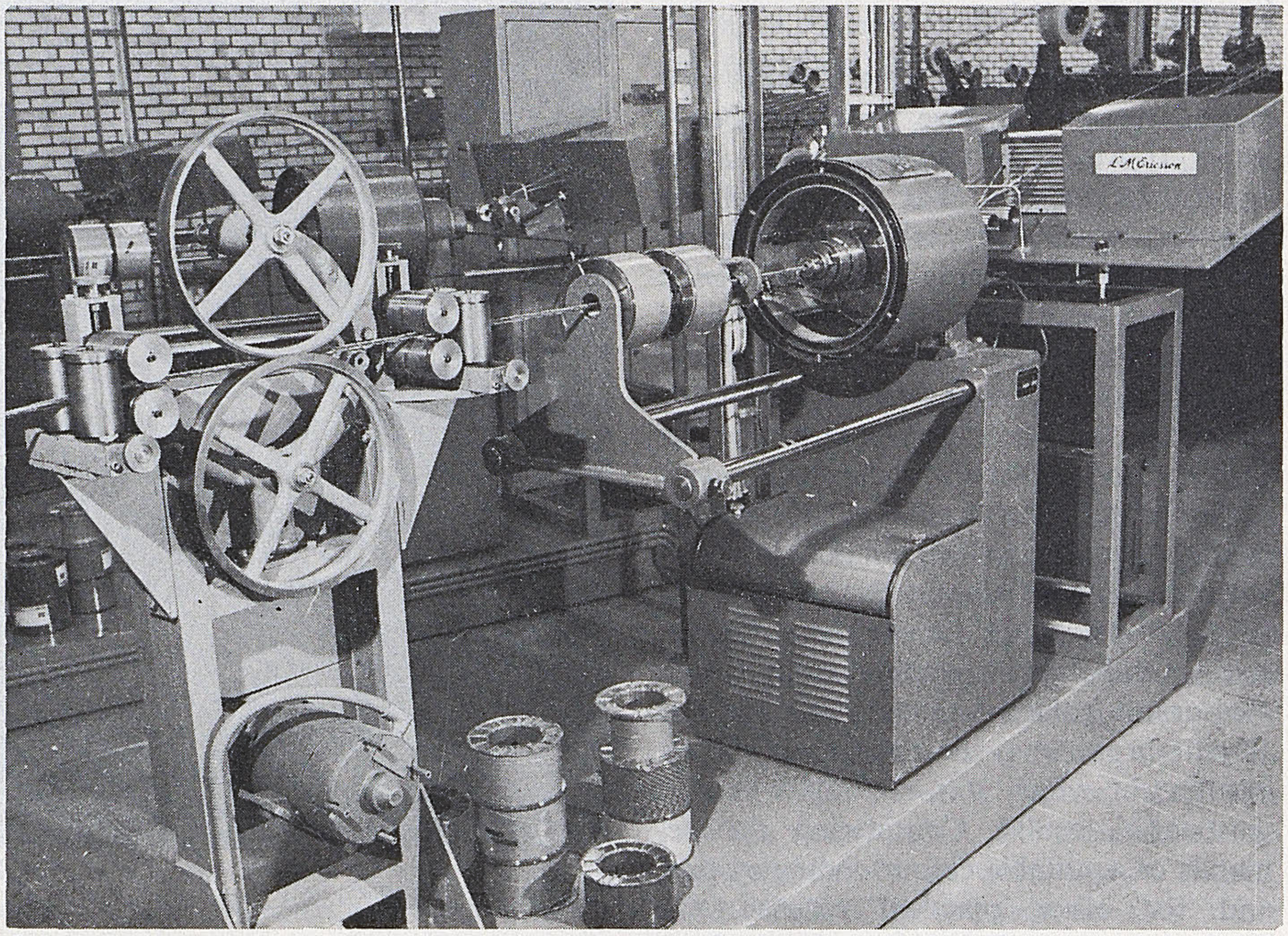
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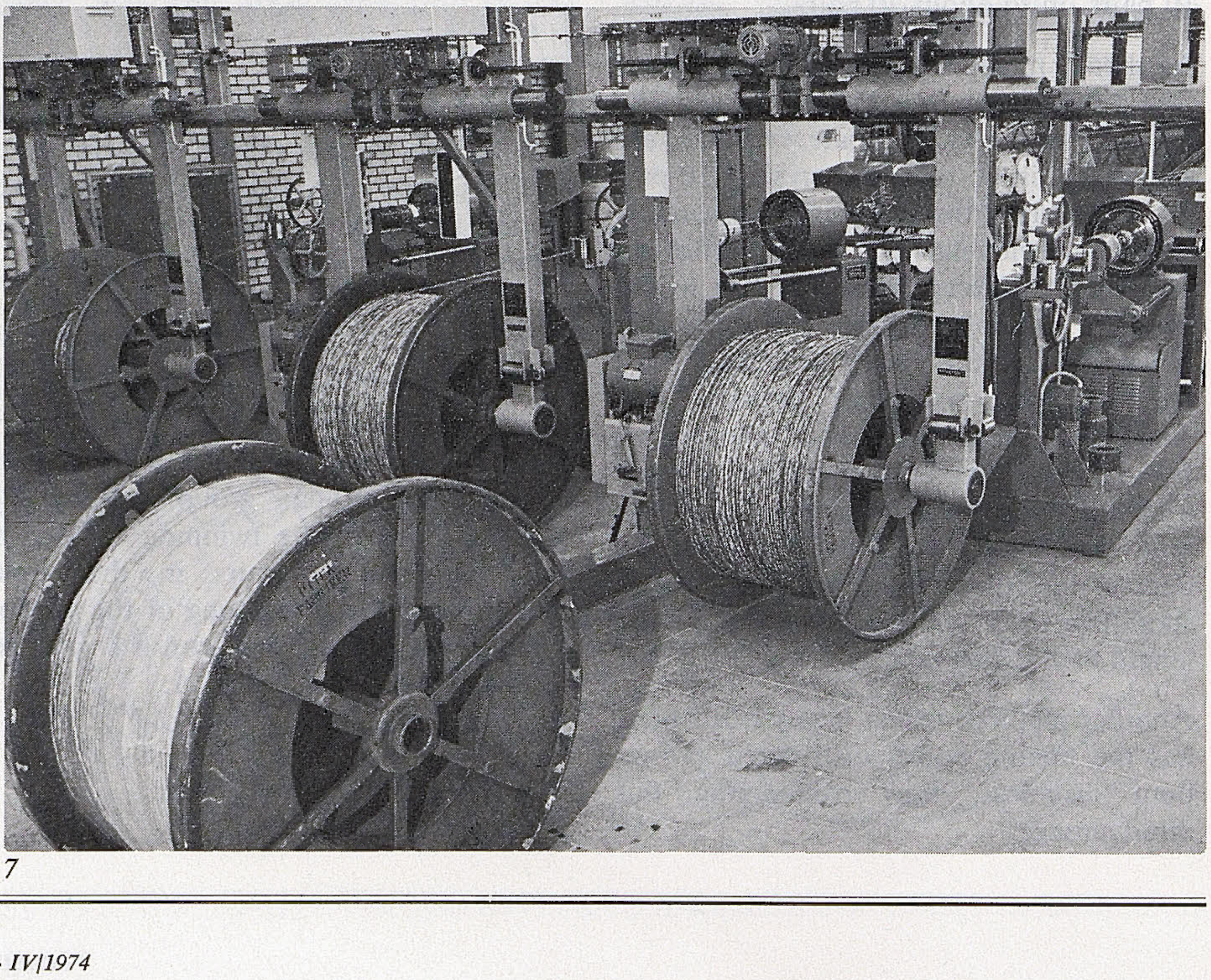

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Figure 4 — Random pulse generator

Figure 5 — Mixer

Figure 6 — Binder head

Figure 7 — Group of take-ups

order they have entered the die. The binder yarn has a suitable colour for identifying purposes.

■ Length measuring device

Figure 6 also shows the length measuring device, including a tachometer, which syncronizes the drive motors of the different components.

■ Take-up unit

No capstan is used, which means that the group is fed directly to the take-up. Any suitable type can be used, and in figure 7 a group of take-ups is demonstrated, using one common frame with all driving parts at the top, thus leaving the floor free.

The components in the production unit have a rather simple design. Considering that a complete 10-pair group is produced from just 20 single conductors, the investment cost is low compared to the conventional way with single twinning machines and a suitable stranding machine. Furthermore, one operator is considered sufficient for more than one group twinner, thus reducing production costs.

The final assembling machine, preferably of a drum twister type, can also be simple, since it needs equipment for just a few let-off devices for the units and no frames for a large number of single pair reels.

Results obtained

Full-scale production with cross-standing is carried out in *LM Ericsson*'s Piteå factory.

The most interesting electrical characteristic is the capacitance unbalance reached during production (figure 8).

As a measurement of the quality of capacitance unbalances the root mean square (RMS) value is given.

For the representative part of the production a distribution diagram is shown in figure 9.

The deviation of mutual capacitance has been studied in a test production where two identical cables were produced, both with 10-pair groups. In one length, however, the 10-pair groups had conventional layer design, 2+8, and the other length was cross-stranded.

	conventional cable	*cross-stranded cable*
mutual capacitance (nF/km)	44	45
standard deviation $\angle 2_{C\,nF}$	0.61	0.35

The diameter of the finished cable is the same and the level of mutual capacitance is also about the same in the new cable compared to the conventional cable.

The splitting-up of a cable into small subunits which are always spliced together in a consecutive way will also give combinations of circuits with very well-defined crosstalk levels. For instance, circuits in two adjacent 10-pair groups will have a higher crosstalk level compared to combinations within a 10-pair group.

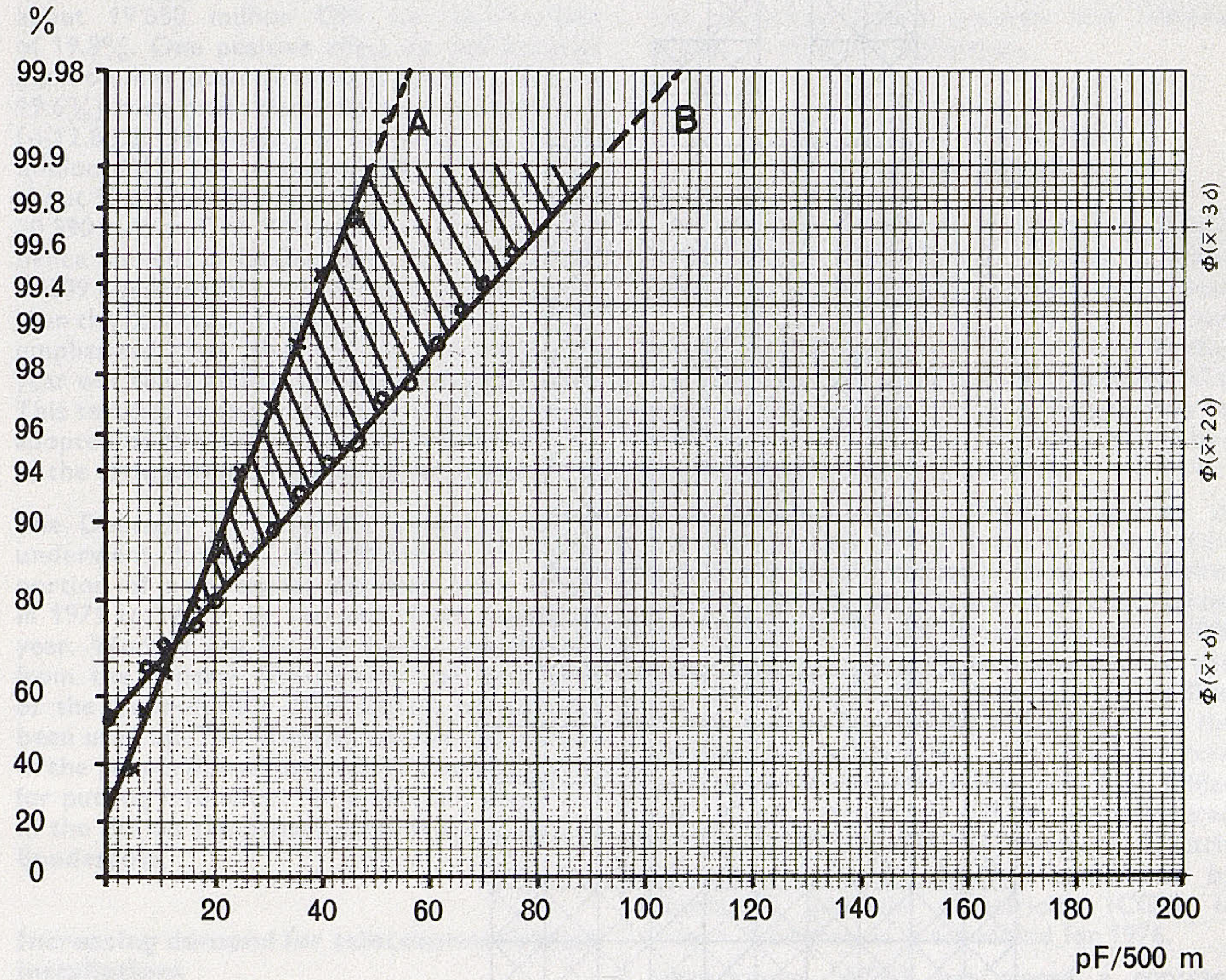

Figure 8

Cross-stranded cable. Capacitance unbalance distribution curve. Insulation: solid polyethylene —conductor size: 5/10 mm—length: 500 m.

Curve A:

Represents capacitance 1000 values within 10-pair groups. Taken from the production during August-September 1972 in Piteå.

Curve B:

Represents capacitance 1000 values within conventional 10-pair groups with lay-up of 2 + 8. Produced during 1971. For correct comparison not adjacent pairs are included and are expected to consist of 90% with the value 0 pF, 7% with the value 5 pF and 3% with the value 10 pF, which have been found adequate at an additional test on conventional layer lay-up.

The shadowed area is the reduction in higher unbalances that can be expected by introducing cross-stranding.

Note:

If a manufacturer finds other values for his curve B (depending on another technique at wire drawing, extrusion and pairing, etc.) then, with that same technique he can calculate approximately, with the help of the shadowed area above, what his reduction will be when he introduces cross-stranding.

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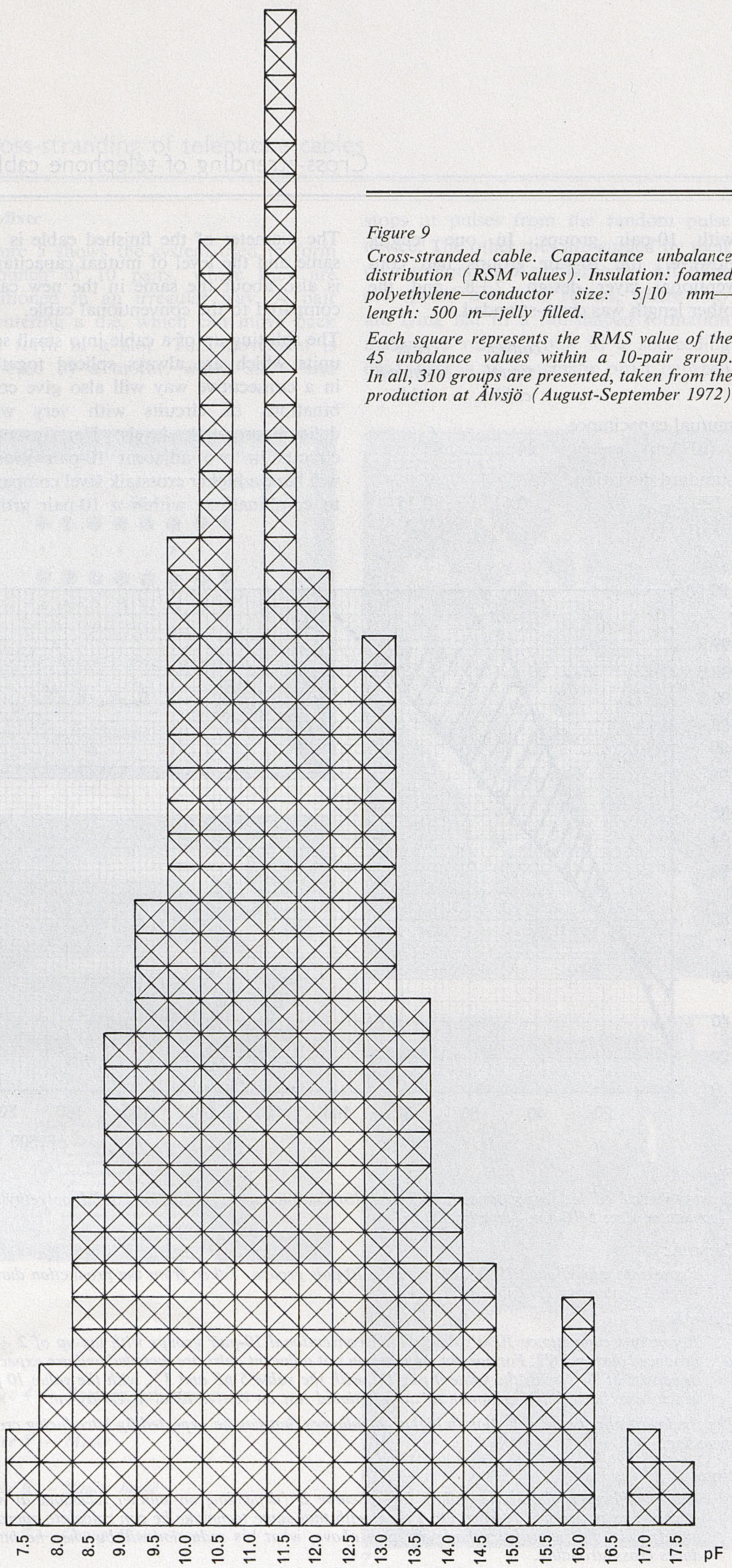


Figure 9
Cross-stranded cable. Capacitance unbalance distribution (RSM values). Insulation: foamed polyethylene—conductor size: 5/10 mm—length: 500 m—jelly filled.

Each square represents the RMS value of the 45 unbalance values within a 10-pair group. In all, 310 groups are presented, taken from the production at Älvsjö (August-September 1972)

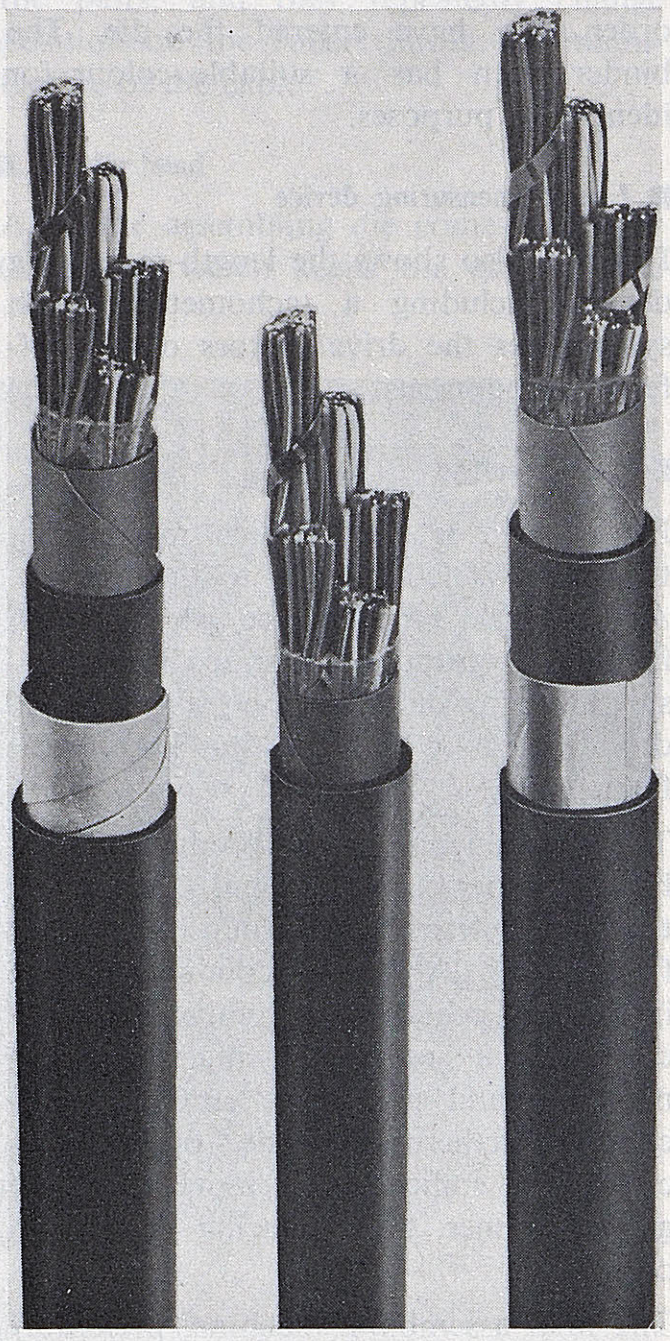


Figure 10
Cable produced by the cross-stranding technique

This is favourable to the introduction of PCM systems, where different transmission directions can easily be introduced in different groups.

An example of cable produced by the cross-standing technique is illustrated in figure 10.

Conclusion

An improvement of the electrical characteristics of the cable has been achieved.

At the same time the following properties have been noted:

1. Reduced investment cost for machinery.
2. Low operating and maintenance costs.
3. Reduction in floor space.
4. Low noise level.

(Original language: English)

news

First ESK 10 000 E telephone exchanges for Brazil

☐ Under Brazil's telephone system development plan *Siemens São Paulo* received from *Telecomunicações Brasileiras SA* (TELEBRÁS), the State holding company for the national private telephone firms, a letter of intent concerning 120 000 telephone connections based on the *ESK 10 000 E* system, which is new to South America. The first definite contract awarded recently for the supply of five local exchanges and a local transit exchange with a total of 55 000 connections, to a value of about 52 million Deutsche marks, was the largest single order so far received by Siemens São Paulo. The new exchanges are intended to replace those at present in use in Curitiba, the capital of the Federal State of Paraná.—*Siemens.*

More telephone lines between Italy and Switzerland

☐ In view of the steady increase not only in telecommunication traffic from Switzerland to Italy but also in transit calls to and from the latter, more links will have to be provided between the two countries.

The Swiss and Italian PTT Administrations have agreed to make greater use, as from 1975, of the capacity of the Martigny—Aosta coaxial cable. A radio-relay telephone link capable of carrying 5400 calls at once will be introduced between Lugano and Milan in 1976 and will replace the Lugano—Milan coaxial cable up to the end of 1977 while the latter is taken out of service to have its capacity increased from 1920 to 5400 channels. When that is finished, the radio-relay link will be used to supplement and reinforce the cable route. — *Entreprise des PTT suisses.*

Deutsche Bundespost's Annual Report for 1972

☐ The *Deutsche Bundespost's* Annual Report for 1972 shows that telecommunications traffic continued to grow, though more slowly than in 1971. The 1972 growth was 8.6% compared with 9.3% for 1971.

The overall increase in demand for post and telecommunication services called for a corresponding increase in plant investment to about 7600 million Deutsche marks. This brought the capital requirement for investment and debt amortization up to a level of roughly 9800 million DM, only about 3100 million of which could be raised from the Bundespost's own resources. It was therefore forced to contract a further debt of about 6600 million DM in 1972.

The increased demand for telecommunication services and the higher rates charged during the reporting year raised the proceeds to about 19 650 million DM, i.e. an increase of 19.8%. One positive effect on the financial position has been that total revenue (up by 19.6%) rose more than the total expenditure (+12.8%). However, at a level of 20 480 million DM, the revenue still covered only about 97.6% of the expenditure, which totalled 20 990 million DM. The profit and loss account hence showed a further loss for 1972 which, at 509.6 million DM, was 975 million DM lower than the corresponding loss in 1971. It should be emphasized that the loss in the reporting year was 488.5 million DM below the estimates. This testifies to the stability-oriented approach adopted by the management and to the success of the rationalization measures introduced.

The Deutsche Bundespost's capital structure underwent further deterioration: the proportion of own capital declined from 19.3% in 1971 to 17.4% by the end of the reporting year. Were it not for the capital transfusions from the Federal Government, all but 0.9% of the Bundespost's own capital would have been used up. The financial loss and the decline in the proportion of own capital show the need for putting into effect the provisions contained in the Bill on the constitution of the Deutsche Bundespost.

Increasing demand for telecommunication installations

☐ The bulk of the investment in the reporting year, totalling about 5800 million DM, was again accounted for by telecommunications. This level of investment—the highest so far—in telecommunication facilities, provided 946 000 new main telephone stations, bringing the total up to 10.83 million. In absolute figures for main telephone stations installed, the Federal Republic of Germany led the field of European countries at the end of 1972.

Rationalization—a continuing task

☐ Rationalization, in order to achieve the maximum operational and administrative efficiency continued, and in 1972, 4288 posts were eliminated. Nevertheless, the number of unfilled vacancies rose from 28 159 in 1971 to 29 200 in 1972. Special tribute should therefore be paid to the achievement of the post office staff in the light of this fact.

Training

☐ The Deutsche Bundespost also strengthened its further-training programme for staff, in addition to the quantitatively and qualitatively excellent training facilities already offered. A leading part in this programme was played by the Executives' Academy *(Akademie für Furhrungskräfte)* with management courses and seminars, special courses and training weeks. — *Deutsche Bundespost.*

Three new undersea telephone cables

☐ Orders for undersea telephone cable and systems worth 30 million pounds sterling have been announced by Standard Telephones and Cables Limited (STC). Three routes, one across the Atlantic and two in the Pacific, are involved. For two of the contracts STC will be making over 4000 nautical miles of submarine cable for the American Telephone and Telegraph Company (AT&T).

The company will supply the majority of the cable to AT&T for *TAT-6*, a 3600 nm system which the latter is laying from St. Hilaire-de-Riez, on the west coast of France, across the Atlantic to Rhode Island. Providing 4000 more telephone circuits between Europe and the United States, this system will be the first to use a new type of cable developed at the company's Southampton cable plant in conjunction with the United Kingdom Post Office and AT&T. Repeaters will be manufactured in the United States by Western Electric Company and the terminal equipment by *Compagnie générale d'électricité* (CGE) of France. Completion is scheduled for 1976.

Furthermore, AT&T has placed a contract with STC to supply cable for *Transpac-2*, a 7000 nm link across the Pacific Ocean which will have a capacity of 845 circuits from the United States to Okinawa, with cable landings at Hawaii and Guam.

The Overseas Telecommunications Commission (Australia) and the New Zealand Post Office have also awarded STC a contract for a complete undersea telephone cable system *(Tasman)* running across the Tasman Sea from Sydney in Australia to Auckland in New Zealand. When completed in 1976, the 1200 nm system, which will include 152 repeaters, will have an initial capacity of 480 telephone circuits, which can be increased to 640 circuits when required.

In the manufacture of the three systems the company will use approximately 16 000 tonnes of polyethylene, 6500 tonnes of galvanized and high-tensile steel wire, 3500 tonnes of copper tape and 150 tonnes of aluminium tape. — *STC.*

United Kingdom trunk calls soar

☐ A record 541 million trunk telephone calls were made in the United Kingdom in the last three months of 1973—58 million more than in the last quarter of the previous year. — *United Kingdom Post Office.*

Telex . . .

. . . automatic service United Kingdom—Jordan

☐ The telex service between the United Kingdom and Jordan went over to automatic working on 22 January 1974.—*United Kingdom Post Office.*

. . . in Libya

☐ A contract for the supply and installation of telecommunications switching equipment for the Posts and Telecommunications Corporation of the Libyan Arab Republic has been awarded to Plessey Telecommunications, United Kingdom.

The order, valued at more than 525 000 pounds sterling, is for two Plessey *4660* computer-based telex exchanges and follows a recent Libyan contract for two Plessey *5005* crossbar telephone exchanges. The combined value of the two contracts is almost 2 million pounds sterling.

The two telex exchanges, which will be installed in Tripoli and Benghazi, will switch international and local telex and gentex traffic at speeds of up to 200 bauds and will provide Libya with one of the world's most advanced telex switching networks. — *Plessey.*

. . . in Peru

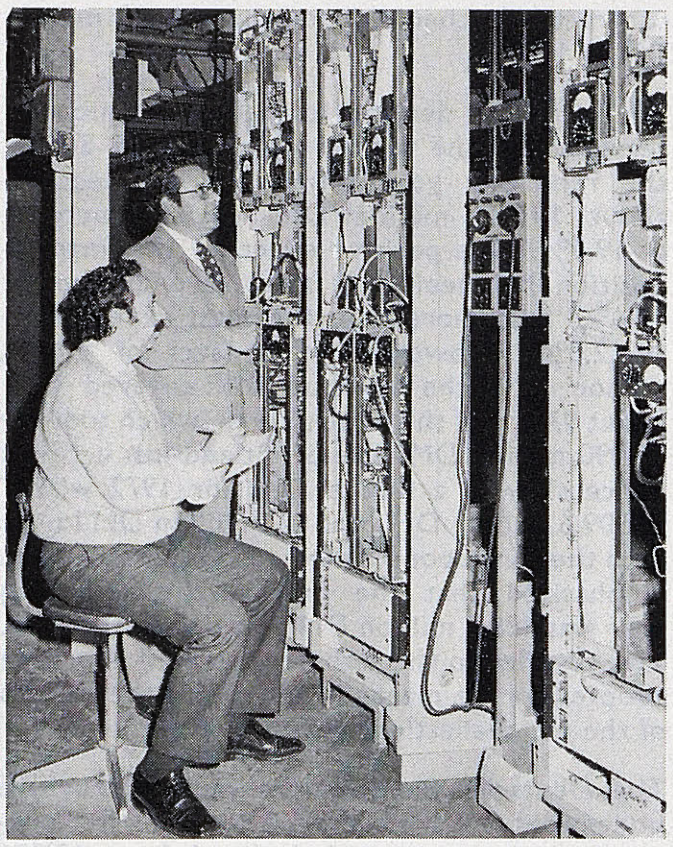
☐ The *Empresa Nacional de Telecomunicaciones* (ENTEL), Peru, and *Siemens AG* recently signed a contract for the supply of a national telex network. The contract, worth about 17 million Deutsche marks, provides for the supply, assembly and bringing into operation of all the equipment required for the project, as well as the training of Peruvian maintenance staff. Altogether, 18 telex offices are to be built in Peru, with about 2400 subscriber connections. In addition, there will be three central offices in Lima, Arequipa and Trujillo, as well as a head office for overseas communications in Lima. — *Siemens.*

. . . in Switzerland

☐ Telex is becoming increasingly popular in Switzerland. In 1973 alone, the PTT registered a record 2158 new connections. These brought the number of telex subscribers up to 19 020 and the telex density up to 30 connections per 1000 inhabitants in round figures. Switzerland is therefore now at the top of the world table in this field, followed by the Federal Republic of Germany and Austria. — *Entreprise des PTT suisses.*

900 km microwave system for Bolivia

☐ The *Empresa Nacional de Telecomunicaciones* (ENTEL) of Bolivia has placed a 3.25 million pounds sterling contract with GEC Telecommunications Limited, United Kingdom, for the installation of a 900 km broadband microwave system. The system will modernize the Bolivian trunk telephone communications network and will provide facilities for television to be relayed from the capital, La Paz, and allow the transmission of telex and data services. It will also enable future international connections to be made with similar systems in the neighbouring countries of Peru, Argentina, Chile and Brazil. — *GEC.*


(GEC)

Mr. J. W. Bustamante, contracting officer for ENTEL of Bolivia, and Mr. Carlos Valera L. (seated), a Bolivian engineer, checking 2 GHz microwave radio equipment prior to dispatch from the Coventry headquarters of GEC

Multi-million pound sterling radio scheme for Caribbean

☐ An agreement between the French Ministry of Posts and Telecommunications and Cable and Wireless Limited for the construction of an eastern Caribbean microwave radio system has been signed recently in London.

The agreement concerns the central section of the system, which will have relay points on the Islands of Antigua, Guadeloupe, Marie Galante, Dominica, Martinique and St. Lucia.

The French Administration will be responsible for the installation and maintenance of the equipment on Guadeloupe, Marie Galante and Martinique and Cable and Wireless for the other islands in the central section.

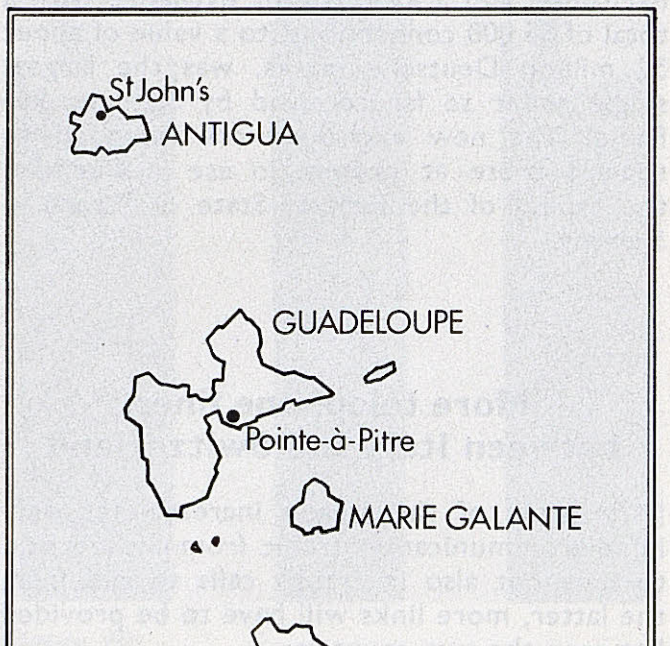
Stretching some 1300 km from the British Virgin Islands in the north to Trinidad and Tobago in the south, the system will be the longest international island-hopping microwave link in the world.

It involves co-operation between Cable and Wireless, French and Netherlands Administrations and the Trinidad and Tobago External Telecommunication Company Limited (TEXTEL).

The cost of the Cable and Wireless and TEXTEL parts of the system will exceed 2 million pounds sterling.

The system can provide 960 telephone channels and have considerable capacity for the transmission of inter-island television, should this be required.

It also has massive capacity for telegraphy, telex and data transmission and is designed



to meet telecommunication demand in the eastern Caribbean until well into the 1980s.

Work has already started on the northern section which links Tortola in the British Virgin Islands with Antigua, via the Netherlands Island of Saba. It is expected to be complete by the end of this year.

The whole system, which feeds into the global telecommunication network at Tortola, Martinique and Trinidad and Tobago, is due to be completed by the end of 1975. — *Cable and Wireless.*

Antenna for world's highest tower

☐ A 1.25 million pounds sterling contract to equip the new high Canadian National observation and communications tower in Toronto, Canada, with a complete antenna complex for all FM and television broadcasting services has been awarded to the Telecommunications Division of EMI Sound and Vision Equipment Limited, Hayes, Middlesex.

According to EMI, when completed the 564 m high tower in Toronto will be the tallest self-supporting structure in the world. The antenna system surmounting the main concrete tower will be carried on a 220 ton needle-shaped steel structure over 91 m tall. — *EMI.*

Queensland railway signalling contract

☐ A 4 million dollar contract has been awarded by the Queensland Government Railways to Page Communications Engineers Pty. Ltd., Sydney, Australia, to provide power signalling, route setting and centralized traffic control. Page will design, supply, install and commission the entire system over a 15-month period. The system is in support of extensive coal mining operations in the State of Queensland and when commissioned will permit the efficient movement of more than 60 trains per day. — *Page.*

Technical co-operation agreement with the USSR

☐ Representatives of the International Telephone and Telegraph Corporation (ITT) and the State Committee for Science and Technology of the Council of Ministers of the Soviet Union signed in Moscow last June an agreement under which ITT and Soviet organizations are to exchange scientific and technical information in four fields: telecommunications, electronic and electromechanical components, consumer goods and the publication of scientific and technical information. For the five years covered by the agreement, each side will make information and technology available to the other. — *Messages.*

United Kingdom Post Office fights pollution

☐ A battery-powered van is to be tried out by United Kingdom Post Office engineers in central London. The van goes on trial shortly under fully-operational conditions, in a detailed two-year evaluation to establish whether electric vehicles are suitable for work with Britain's telecommunication services.

With more than 50 000 vehicles on the road Post Office Telecommunications is the United Kingdom's biggest commercial fleet operator. The primary function of the great majority of these vehicles is not to carry goods over big mileages—but to get installation, maintenance and repair engineers to their work with all the equipment they need. As a result the average daily distance covered by these mobile telephone workshops is about 40 km. Over the year this is less than is covered by the average car-owner.

(United Kingdom Post Office)

Battery-powered van to be tried out by Post Office telephone engineers in central London

The vehicle being tested is the Harbilt electric model *HSV-3*. It is powered by two conventional 72 V Exide batteries and has a range of between 55 and 65 km on a single charge and top speed of 45 to 50 km per hour.

Electric vehicles are, of course, environmentally " clean ". — *United Kingdom Post Office.*

Fiftieth Anniversary of Wandel und Goltermann

☐ At the end of 1973 the firm of *Wandel und Goltermann*, Reutlingen, celebrated its golden jubilee.

Founded in 1923 by Wolfram Wandel and Ulrich Goltermann, the firm concentrated chiefly on radio and telecommunications equipment.

After the end of the war it developed its first professional measuring apparatus and now attains a turnover of over 50 million Deutsche marks in this branch. — *Wandel und Goltermann.*

Japanese meteorological satellite

☐ The Nippon Electric Company Limited (NEC) has been chosen as prime contractor for the Japanese meteorological satellite to be launched in late 1975—early 1976 by an American rocket from Cape Canaveral and placed in a geostationary orbit. The Hughes Aircraft Company, which will be working with NEC on the project, will supply the two-channel (visible and infrared) radiometer for the satellite. — *Air et Cosmos.*

Optical fibre agreement

☐ British Insulated Callender's Cables Limited (BICC), the Corning Glass Works of New York and the Plessey Company Limited have announced a tripartite agreement for the development of glass fibres for use as the transmission medium of communications systems.

This agreement arises from a recognition by the three parties that advanced optical techniques have great potential in future communications. — *BICC.*

Zaire receives new radio network

☐ *Siemens AG* will shortly be supplying about 40 million Deutsche marks worth of equipment to establish a radio network for Zaire's regional, national and international broadcasting. The project covers 11 medium- and short-wave transmitters with a total carrier power of 900 kW, to be installed at various points throughout the country, together with a separate short-wave news and programme transmission network consisting of 16 double-sideband transmitters (5/10 kW) and a central short-wave receiving station in Kinshasa. For regional programme production, eight radio centres with production and transmitting studios for music and speech, including press, film and photographic facilities, are also to be set up. Other short-wave and radio-relay links are planned for the further expansion of the radio network. — *Siemens.*

Personnel changes . . .

. . . in Japan

☐ Mr. Yoshio Sano has been appointed Director General of Telecommunications, Ministry of Posts and Telecommunications, replacing Mr. Yasuo Makino. Accordingly, the Directors General of Telecommunications are Messrs. Kisaku Asami and Yoshio Sano.

. . . in Senegal

☐ Mr. Mame N'Daraw Cisse has been appointed Director of the Posts and Telecommunications Office, to replace Mr. Ibrahima N'Diaye who has been appointed to another post.

Mr. Alioune M'Bodji Dione has been appointed Chief of the Telecommunications Division.

. . . in Spain

☐ The following appointments have been made in the Spanish Government and in the Posts and Telecommunications Administration:

- — Mr. Carlos Arias Navarro, President of the Government;
- — Mr. José García Hernández, Minister of the Interior;
- — Mr. Luis Rodríguez Miguel, Minister of Housing;
- — Mr. León Herrera Esteban, Under-Secretary, Ministry of the Interior;
- — Mr. Pedro Sánchez Pérez, Director-General of Posts and Telecommunications;
- — Mr. Isidro Pérez-Beneyto y Canicio, Secretary-General in the General Directorate of Posts and Telecommunications.

. . . in the United Arab Emirates

☐ Mr. Mohammed Said al-Mulla has been appointed Minister of Communications in place of Sheikh Abdul Aziz bin Rashed al-Nuei'mi who has become Minister of Social Welfare.

technical news

News from INTELSAT . . .

. . . demand-assigned satellite service now available in Atlantic area

☐ A new digital demand-assigned communications satellite service *(Spade)* is now in full-time commercial operation in the International Telecommunications Satellite Organization (INTELSAT) system for a number of countries in the Atlantic area for voice communications.

The Spade system permits international long-distance calls to be dialled between countries utilizing a common pool of frequencies set aside in an *Intelsat-IV* Atlantic satellite on an as-needed or demand-assigned basis. The INTELSAT charges made to a telecommunications entity are based on its use of the system. Earth stations equipped for this service are located in Argentina, Brazil, Canada, France, Federal Republic of Germany, Greece, Italy, Peru, United States and the Nordic countries of Denmark, Finland, Norway and Sweden. A number of other countries plan to place Spade terminals into service this year. — *INTELSAT.*

" Symphonie "—progress of tests at the Toulouse Space Centre

☐ The first components for the *Symphonie* prototype arrived at the Toulouse Space Centre on 12 December 1973 for a number of tests which should be concluded by 6 April 1974.

This series of tests comprised:

- *Vacuum and temperature tests*

The prototype was subjected to test temperatures under a vacuum of 10^{-5} torr:

- — short high and low temperature stages of 12 hours each;
- — long high temperature stage of 100 hours, followed by a long low temperature stage of 70 hours;
- — short high and then low temperature stages of 6 hours.

- *Vacuum-sun tests*

While still under a vacuum of 10^{-5} torr, the Symphonie prototype was taken through four stages of insolation tests:

- — three phases in a simulated geostationary orbit: equinox, low solstice and then high solstice with a simulated eclipse;
- — a stage in a simulated transfer orbit.

- *SHF compatibility tests*

During the same period, SHF compatibility tests will be carried out on the Symphonie station at the Toulouse Space Centre. These will also be the first operating tests for this station. — *Centre national d'études spatiales, France.*

" Heos-2 " in orbit two years

☐ The European Space Research Organisation (ESRO) fifth satellite, *Heos-2*, completed its 140th orbit and second year in space on 31 January 1974 with all experiments still operating well. Its planned operational lifetime was 18 months.

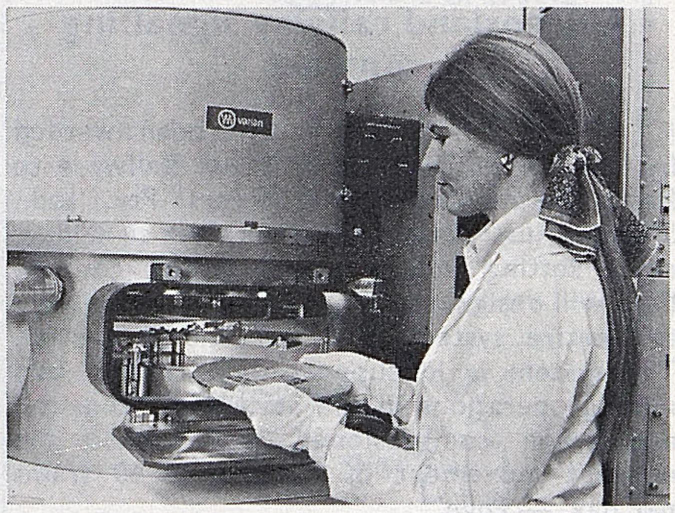
The satellite is in a highly eccentric orbit around the earth with an apogee 240 000 km above the North Pole in a region not previously studied. Its main mission is the investigation of the magnetic field and of energetic particles in this polar region, which is important for the understanding of many ionospheric and auroral phenomena. Measurements made by the satellite have shown that the high-latitude magnetospheric boundaries are about 20% further from the earth than was previously believed on the basis of theory and measurements made at lower latitudes. A new transition layer of protons has been found in the high-latitude magnetosphere along the magnetopause. This boundary has also been found to contain a permanent layer of energetic electrons of unexpected high energies.

Heos-2 is expected to re-enter the atmosphere in July 1974. — *ESRO.*

Multitarget sputtering system for production of pure thin films

☐ For production deposition of pure thin films, Varian Vacuum Division has announced a new multiple target sputtering system with a new *Sputtorr** pump module that is six times faster than conventional turbomolecular pumps. Consistent reproducibility and high process yield result from the new system design, which integrates good vacuum and sputtering technology.

The sputtering chamber has convenient front-door loading and contains up to four 150× 200 mm targets with either manual or automatic matching network controls. Operator judgment is minimal, involving only the positioning of one row of lights on the control panel.



(Varian)

Sputtorr pump module

By delivering six times the speed of typical 400 l/s turbomolecular pumps and doubling the speed of large 800 l/s pumps during the sputtering process, the Sputtorr pump module reduces the chamber contamination level significantly. An automatic high vacuum valve, part of the pumping system, controls crossover from rough to high vacuum pumping at 200 microns to reduce mechanical pump back-streaming and eliminate primary backstreaming from the diffusion pump. This unique capability enhances the purity of the coating environment and the reliability of the end product. — *Varian.*

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* Trade mark.

New single-channel station system

☐ A new low-cost single-channel station system providing a new subscriber line which is added to the single or party lines already in place on a cable pair, has been developed by *GTE Lenkurt*.

According to the manufacturer, the principal function of the system will be to create new lines, improve existing services, provide duplication of a particular service, improve service at peak periods and provide emergency services. The equipment operates on push-button sets and can be used on private automatic branch exchanges.

The system uses a double sideband amplitude-modulated signal at a frequency of 76 kHz from exchange to subscriber and 28 kHz from subscriber to exchange. Inter-system interference is reduced to a minimum by automatic adjustment of the carrier levels. This system enables 100% use to be made of cable capacity and in addition is simple to install and maintain since no adjustment is needed. — *GTE International*.

SATELLITE LAUNCHINGS NOTIFIED DURING PERIOD 1 JANUARY TO 13 FEBRUARY 1974

Code name Spacecraft description	International number	Country Organization Site of launching	Date	Perigee* Apogee	Period* Inclination	Frequencies Transmitter power	Observations
Cosmos-628	1974-1-A	USSR (Plesetsk)	17 Jan.	975 km 1026 km	105 min 83°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radio telemetry system. Navigational satellite
Skynet-IIA	1974-2-A	United Kingdom Ministry of Defence (Eastern Test Range)	19 Jan.	1074 km 31 300 km intended for synchronous orbit over Indian Ocean	 26.5°		Spacecraft was rendered useless due to a launch mishap
Cosmos-629	1974-3-A	USSR (Plesetsk)	24 Jan.	202 km 315 km	89.4 min 62.8°	19.995 MHz	Carries scientific apparatus, radio system for precise measurements of orbital elements and radio telemetry system
Cosmos-630	1974-4-A	USSR (Plesetsk)	30 Jan.	213 km 367 km	90 min 72.9°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radio telemetry system. Reconnaissance/surveillance satellite
Cosmos-631	1974-5-A	USSR (Plesetsk)	6 Feb.	522 km 565 km	95.3 min 74.0°		Carries scientific apparatus, radio system for precise measurements of orbital elements and radio telemetry system. Navigational satellite
Cosmos-632	1974-6-A	USSR (Baikonur)	12 Feb.	184 km 333 km	89.4 min 65°		Carries scientific apparatus, radio system for precise measurements of orbital elements and radio telemetry system. Reconnaissance/surveillance satellite
Samos...	1974-7	United States US Air Force (Western Test Range)	13 Feb.	132 km 404 km	89.9 min 110.4°		Reconnaissance/surveillance satellite

* Initial orbital data.

Sources: *COSPAR, NASA, Specialized Press.*

UTILIZATION OF INTELSAT TELECOMMUNICATION SATELLITES

DECEMBER 1973

region	general telecommunications	television service	
	number of telephony circuits leased on full-time basis at end of month (see note *a)*)	number of transmissions	transmit time (see note *b)*)
Atlantic Pacific Indian	3144 1125 635	281 25 6	184 h 26 min 50 h 31 min 2 h 22 min

Notes:

a) Includes leased telex and data circuits expressed in terms of telephony-circuit equivalent. Excludes circuits used on an occasional basis for cable restoral and for peak demands. INTELSAT's revenues from leased circuits as shown in the table represent the great bulk of INTELSAT's total receipts from operations.

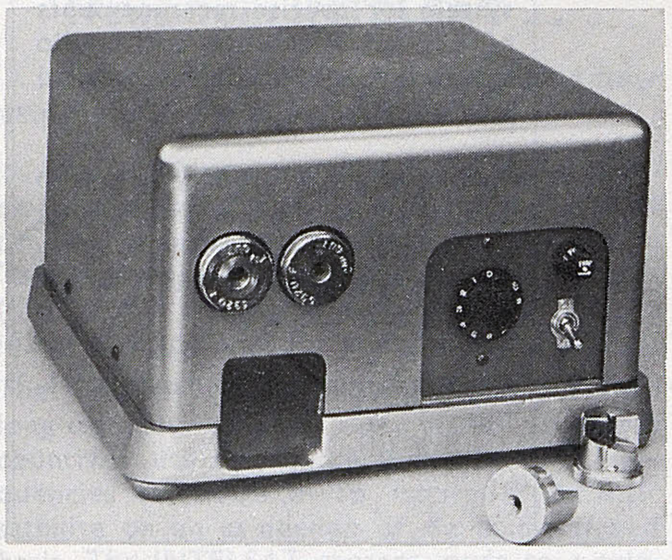
b) Represents the combined total of all periods of transmission. Receive time is somewhat higher because of some multi-destination transmissions. INTELSAT's total revenues from television service normally represent considerably less than 5% of INTELSAT's total receipts from operations.

Source: COMSAT European Office, Geneva.

new products

Coaxial cable trimmer

☐ Utility Tool Corporation of East Haddam, Connecticut, a subsidiary of Ripley Company, Incorporated, has announced the development of a powered coaxial cable trimming machine. A special feature of this unique machine is its ability to strip jackets and dielectric without damaging the underlying shield and centre conductor.



(Utility Tool Corporation)

Coaxial cable trimmer

The rate of operation is from 750 to 1250 cable ends per hour, depending upon the size of coaxial cable. The trimming heads can be changed in less than 30 seconds to accommodate other cable sizes. The simplicity of operation makes it easy, even for unskilled personnel, to operate the unit in minutes with consistent trim lengths.

The *WS-33* unit will accommodate coaxial cables up to 11.1 mm outside diameter. — *Utility Tool Corporation.*

(Utility Tool Corporation, Town Street, East Haddam, Connecticut 06423, United States)

Solid state amplifier for microwave communications applications

☐ Varian's new medium power transistor amplifier *VSG-7425F* is intended for use as a receiver post amplifier in commercial satellite ground stations and as a transmitting amplifier in commercial line-of-sight microwave systems.

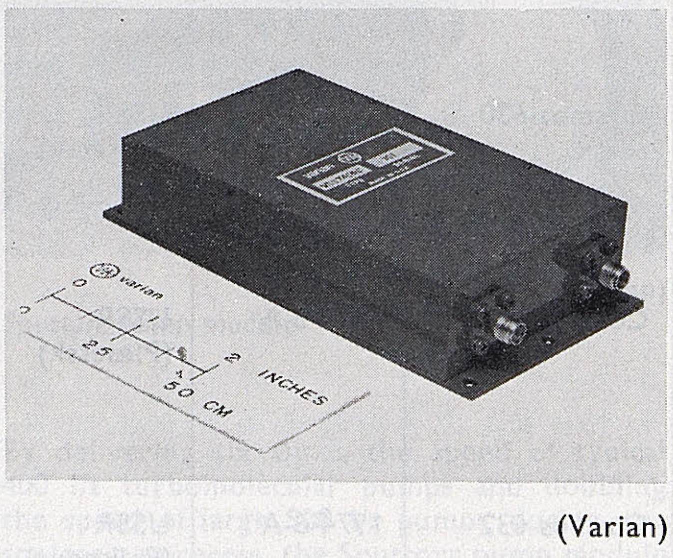
Typically delivering more than 250 mW, the high power output satisfies the stringent third order intermodulation products and AM/PM conversion specifications required in most communication systems.

Frequency range is 3.7 to 4.2 GHz, and minimum power output at saturation is +23 dBm. Typical noise figure is 8.5 dB, and small signal gain is typically 37 dB. Weight is 285 g, and size 26×64×108 mm. — *Varian.*

Medium power solid state amplifier

☐ A new S-band solid state amplifier unit has been introduced by Varian.

The medium power device is a low noise package suitable for use as a radar driver and as an augmentor which requires high power output capabilities.



(Varian)

The VSS-7455C solid state amplifier

The *VSS-7455C* is rated at over 400 mW output; bandwidth is 2.8 to 3.6 GHz. The compact unit is 26×64×108 mm. Weight is 280 g. — *Varian.*

(Varian, Solid State West Division, 611 Hansen Way, Palo Alto, California 94303, United States)

ITU
film library

Ref. ITU-113

Pays — Country — País: ESPAGNE — SPAIN — ESPAÑA

Titre — Title — Título: RITMOS TELEGRÁFICOS (Rythmes télégraphiques — Telegraphic rhythms)

Format — Size — Tamaño: 16 mm *Durée — Duration — Duración:* 10 min

Langue — Language — Idioma: espagnol/français — Spanish/French — español/francés

Observations — Remarks — Observaciones: couleur — colour — color

Sujet — Subject — Asunto: Ce film illustre le développement des télécommunications en Espagne.

Il s'adresse aussi bien au grand public qu'aux techniciens.

This film shows the development of telecommunications in Spain.

Audience: general, technical.

Se muestra en esta película el desarrollo de las telecomunicaciones en España.

Carácter: general y técnico.

Editeur — Producer — Editor: Dirección General de Correos y Telecomunicación, Madrid

Date d'arrivée à l'UIT — Date of arrival at ITU — Fecha de recepción en la UIT: mai 1971 — May 1971 — mayo de 1971

Ref. ITU-115

Pays — Country — País: ETATS-UNIS — UNITED STATES — ESTADOS UNIDOS

Titre — Title — Título: SPACE IN THE 70s — MAN IN SPACE: THE SECOND DECADE (L'espace entre 1970 et 1980 — La deuxième décennie de l'aventure de l'homme dans l'espace — El espacio en el decenio de 1970 — El hombre en el espacio: el segundo decenio)

Format — Size — Tamaño: 16 mm *Durée — Duration — Duración:* 28 min

Langue — Language — Idioma: anglais — English — inglés

Observations — Remarks — Observaciones: couleur — colour — color

Sujet — Subject — Asunto: Ce film donne une description détaillée du programme des vols spatiaux d'engins habités et découvre les perspectives envisagées pour les prochaines années. Il évoque les missions *Apollo* sur la Lune en 1971 et 1972, le premier laboratoire spatial expérimental *Skylab*, ainsi que la navette spatiale qui fonctionnera plus tard au cours des dix prochaines années. Le film donne également un aperçu des programmes spatiaux qui seront mis en œuvre après 1980 et montre une station spatiale, une navette nucléaire, un remorqueur spatial et des missions interplanétaires entreprises avec des engins habités.

Il s'adresse aux techniciens.

This film details the manned space flight activities programmed and those under study, as well as giving a glimpse into the 1970s and beyond. *Apollo* lunar missions of 1971 and 1972, the first experimental space laboratory *(Skylab)*, and the space shuttle later in the decade are all covered. The film also includes a glimpse of future space programmes beyond the 1970s, with illustrations of the space station, nuclear shuttle, space tug and manned interplanetary missions.

Audience: technical.

Esta película reseña las actividades en materia de vuelos espaciales tripulados, programadas y en estudio, anticipando las que podrán tener lugar en el decenio de 1970 y posteriormente. Trata de las misiones lunares *Apollo* de 1971 y 1972, del primer laboratorio espacial experimental *(Skylab)*, y del transbordador espacial previsto para fines del decenio. La película revela asimismo algunos de los futuros programas espaciales para los años posteriores al decenio de 1970, ilustrando la estación espacial, el transbordador nuclear, el remolcador espacial y las misiones interplanetarias tripuladas.

Caracter: técnico.

Date d'arrivée à l'UIT — Date of arrival at ITU — Fecha de recepción en la UIT: mai 1971 — May 1971 — mayo de 1971

note from the CCIR

basic indices for ionospheric propagation

THE FOLLOWING TABLES, giving values of the basic indices for ionospheric propagation, have been prepared by the Specialized Secretariat of the International Radio Consultative Committee (CCIR) in accordance with Resolution 4-1, Recommendation 371-1 and Report 246-2 of the XIIth CCIR Plenary Assembly (New Delhi, January-February 1970). In order to expedite the dissemination of the forecasts, the CCIR Secretariat prepares a monthly circular which is sent to administrations, about the 10th of each month, in conformity with the conditions given in circular-letter No. A.C./131 of 14 February 1969. Copies of these forecasts may be obtained, free of charge, from the Director of the CCIR, ITU, Place des Nations, 1211 Geneva 20, Switzerland.

Parameters:

R_{12} (smoothed mean, over twelve months, of the number of sunspots observed):

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
1972	71	71	72	73	73	70	68	65	62	60	58	55
1973	50	46	44	42	40	39	37	36				

I_{F_2} (ionospheric index) *

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
1973	41	46	41	30	43	37	32	25	45	26	11	4
1974	6	7										

* *For further details, see the* Telecommunication Journal, *April 1964, page 119, and January 1966, pages 43-47.*

Φ (monthly mean value of solar noise flux at 2800 MHz at 1700 h UT) **:

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
1973	102	99	100	105	97	91	84	83	106	88	82	84
1974	83	81										

** *Data kindly supplied by the National Research Council, Ottawa.*

Φ_{F_2} (ionospheric index) ***

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
1973	102	104	94	93	96	94	89	86	96	90	85	83
1974	79	80										

*** *For further details, see the* Telecommunication Journal, *September 1967, pages 354-356, and December 1968, pages 678-679.*

See also: Joachim M.: " Korrelation der Werte des solaren Index Φ und des ionosphärischen Index Φ_{F2} " — *Kleinheubacher Berichte*, Vol. **17** (1973).

Forecasts:

R_{12} ****

Month Year	3	4	5	6	7	8
1974	23	22	21	19	18	17

**** *Data kindly supplied by Professor Waldmeier, Federal Observatory, Zurich.*

Estimated error in forecasts of R_{12} six months in advance: ±18.

Mean error in R_{12} predictions based on the 12 months preceding the month following that for which the last R_{12} value was calculated:

Prediction time (months)	0	1	2	3	4	5
Mean error	−1.9	−2.0	−2.4	−3.0	−4.4	−5.2
Standard deviation of the error	2.6	2.4	2.8	3.5	4.8	6.0

I_{F_2} *****

Month Year	2	3	4	5	6	7	8
1974	10	11	10	9	7	6	(4)

***** *Data kindly supplied by the Science Research Council, Appleton Laboratory, Slough.*

The figure in brackets is the value forecast six months in advance.

Mean error in I_{F_2} predictions calculated over the 12 preceding months:

Period of prediction (months)	0	1	2	3	4	5	6
Mean error	2.3	3.1	3.3	3.2	2.9	2.1	1.7
Standard deviation of the error	8.7	10.3	10.1	9.5	9.0	8.6	8.0

Φ ******

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
1974		89	89	88	88	88	88	86	84	83	82	82
1975	82	82	81									

Mean error in Φ predictions calculated over the 12 preceding months:

Period of prediction (months)	0	1	2	3	4	5	6	7	8	9	10	11	12
Mean error	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.7	0.6	0.3	0.0	—0.3	—0.7
Standard deviation of the error	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7

Φ_{F_2} ******

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
1974			86	86	86	86	85	84	83	83	83	82
1975	82	81	82									

****** *Prediction by a method of extrapolation devised by the CCIR Secretariat, pursuant to Resolution 30 of the XIIth CCIR Plenary Assembly (New Delhi, 1970). (Use of the electronic computer in predicting basic indices for ionospheric propagation.)* See Joachim M., Gromov A., and Guillot P.: " Prévisions des indices Φ et Φ_{F_2} de la propagation ionosphérique " — *Comptes rendus de l'Académie des sciences*, Paris, Vol. **275**, No. *13*, B series, 25 September 1972, pages 473-476.

Mean error in Φ_{F_2} predictions based on the 12 preceding months:

Prediction time (months)	0	1	2	3	4	5	6	7	8	9	10	11	12
Mean error	1.7	1.7	1.7	1.6	1.6	1.5	1.4	1.3	1.1	0.7	0.4	0.0	—0.6
Standard deviation of the error	4.7	4.7	4.7	4.7	4.6	4.5	4.4	4.4	4.3	4.3	4.4	4.5	4.7

review of reviews

A list of articles in other technical publications which may be of interest to readers of the Journal. The articles are listed under the language of the publication.

FRENCH

Annales des télécommunications. Centre national d'études des télécommunications, 38, rue du Général-Leclerc, 92 Issy-les-Moulineaux. Année 1973. **Nos 11-12.** P. 459-468. *Arquès P. Y, Macchi O., Vezzosi G.* Trois procédures de détection-estimation simultanées d'un signal.

Automatisme. 16, boulevard St-Germain, 75005 Paris. Année 1973. Nº **12.** P. 449-457. *Gicquello L., Leger Ph.* L'apport des télécommunications à la gestion décentralisée dans les entreprises.

Echo des recherches (L'). Centre national d'études des télécommunications, 38-40, rue du Général-Leclerc, 92131 Issy-les-Moulineaux. Année 1974. Nº **75.** P. 12-23. *Hénaff J., Le Contellec M., Rudelle C.* Amplification des ondes élastiques de surface — P. 24-33. *Berbinau J.* Le projet SEQUIN.

Electronique. Fachschriftenverlag Aargauer Tagblatt AG, Bahnhofstrasse 39-43, 5001 Aarau. Année 1973. Nº **4.** P. 39-42. Introduction aux circuits MOS complémentaires *(2e partie).*

Nº **5.** P. 21-25. Introduction aux circuits MOS complémentaires *(3e partie).*

Electronique et microélectronique industrielles. Société des éditions radio, 8, rue de l'Ancienne-Comédie, 75006 Paris. Année 1974. Nº **182.** P. 31-39. *Piermont M.* Les systèmes d'acquisition numérique de mesures, critères de choix — P. 65-71. *Decès G.* Comment choisir un amplificateur opérationnel.

Electronique professionnelle. Edition professionnelle du Haut-parleur, Société des publications radio-électriques et scientifiques, 2 à 12, rue de Bellevue, 75019 Paris. Année 1974. Nº **1438.** P. 35-41. *Aschen R.* Compresseur digital pour modulation multiplex par impulsions codées.

Industries électriques et électroniques. 13, rue Hamelin, 75783 Paris Cédex 16. Année 1973. Nº **7.** P. 19-32. *Chevrier C.* L'énergie nucléaire et l'électricité.

Onde électrique (L'). Division électronique, radioélectricité et télécommunications (DERT) de la Société des électriciens, des électroniciens et des radioélectriciens (SEE), 10, avenue Pierre-Larousse, 92 Malakoff. Année 1973. **Décembre.** P. 405-411. *Chramiec J., Coumes A.* Etude d'un amplificateur paramétrique « équilibré ».

Recherche (La). Société d'éditions scientifiques, 4, place de l'Odéon, 75006 Paris. Année 1974. Nº **42.** P. 130-138. *Houssin J.P.* Les télécommunications spatiales.

Revue de l'UER.* Union européenne de radiodiffusion, Centre technique, 32, avenue Albert Lancaster, 1180 Bruxelles. Année 1973. Nº **142.** P. 284-287. *Ilmonen K.* Les signaux d'identification de programme, lueur d'espoir pour les auditeurs insatisfaits.

Toute l'électronique. Société des éditions radio, 9, rue Jacob, Paris VI. Année 1974. **Janvier.** P. 41-42. *Sarteaux J.P., Girard J.P., Roussy G.* L'amplification des signaux à faible modulation d'amplitude.

ENGLISH

Bell Laboratories Record. 600 Mountain Avenue, Murray Hill, New Jersey 07974. Year 1973. **No. 11.** P. 352-358. *Kelly T.J., Torok G.P.* Getting the big picture with a picturephone ® set.

Communications News. 402 West Liberty Drive, Wheaton, Illinois 60187. Year 1974. **January.** P. 20-22. *Bourne K.M.* Medical center saves over $30,000/month on phone bill — P. 24. *Oss G.K.* Data system provides alternate approach to mobile digital communications.

COMSAT Technical Review. 950 L'Enfant Plaza, SW, Washington, DC 20024. Year 1973. **No. 2.** P. 301-322. *Assal F.* Approach to a near-optimum transmitter-receiver filter design for data transmission pulse-shaping networks — P. 419-430. *Welti G.R.* Application of hybrid modulation to FDMA telephony via satellite.

Electronics and Power. Institution of Electrical Engineers, Savoy Place, London WC2R OBL. Year 1974. **No. 1.** P. 8-14. *Wilcock J.D.* Semiconductor memories—an electronics revolution.

No. 2. P. 57-60. *Murphy J.* Semiconductor power.

Fujitsu Scientific and Technical Journal. Fujitsu Limited, 1015 Kamikodanaka, Nakahara-ku, Kawasaki 211. Year 1973. **No. 4.** P. 19-40. *Sekigawa M., Kamiya I., Yakuwa K.* CS-36 M submarine coaxial cable system.

Hewlett-Packard Journal. 1501 Page Mill Road, Palo Alto, California 94304. Year 1974. **January.** P. 10-19. *Baldwin R.R., Grote B.E., Harland D.A.* A laser interferometer that measures straightness of travel.

ICAO Bulletin.** International Civil Aviation Organization, 1080 University Street, Montreal 101, PQ. Year 1973. **November.** P. 24-27. *Perkinson R.E.* The case for time/frequency collision avoidance — P. 28-31. *Follen R.J.* The case for a transponder concept in collision avoidance.

Radio and Electronic Engineer (The). The Journal of the Institution of Electronics and Radio Engineers, 8-9 Bedford Square, London WC1B 3RG. Year 1973. **No. 12.** P. 729-743. *Weaver L.E.* The design of a precision video delay line — P. 751-756. *Waldron R.A.* The theory of coupling in a tapered waveguide.

Radio Engineering and Electronic Physics. *(English edition of* **Радиотехника и Злектроника***).* Publishers: Scripta Publishing Company, 1511 K Street, NW, Washington DC 20005. Year 1972. **No. 12.** P. 1993-1999. *Kolosov M.A., Yakovlev O.I., Kruglov Yu.M., Trusov B.P., Yefimov A.I., Kerzhanovich V.V.* Radio sounding of the Martian atmosphere by spacecraft.

Radio Science. American Geophysical Union. 1707 L Street, NW, Washington DC 20036. Year 1973. **No. 11.** P. 991-1005. *Frankel M.S.* LF radio noise from the Earth's magnetosphere.

No. 12. P. 1093-1109. *Cutolo M.* Selective fading and the propagation of radio waves in the magnetoplasma (ionosphere).

Spectrum. The Institute of Electrical and Electronics Engineers, Incorporated, 345 East 47th Street, New York, NY 10017. Year 1973. **November.** P. 28-35. *Feth G.C.* Memories are bigger, faster and cheaper — Semiconductor use is growing; cores are improving; bubbles, optics, and charge transport are on the way.

Systems Technology. The Plessey Company Limited, Ilford, Essex. Year 1973. **No. 17.** P. 8-15. *Avery J.A., Tyler P.* Design of a 30-channel PCM transmission system.

Telecommunications and Radio Engineering. *(English edition of* **Злектросвязь** *and* **Радиотехника***).* Publishers: Scripta Publishing Company, 1511 K Street, NW, Washington, DC 20005. Year 1973. **No. 1.** P. 1-5. *Misulovin L.Ya.* Automatic switching — A system of quasi-electronic automatic telephone offices — P. 5-9. *Ravich V.Z.* Reliability of the logical blocks of switching system control devices.

Telecommunications International (TCS). Horizon House, 610 Washington Street, Dedham, Massachusetts 02026. Year 1973. **December.** P. 27-32. *Warkow C.D.* Competitive communications—a user's reaction.

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* This review is also published in English under the title *EBU Review.*

** This review is also published in French and Spanish with the following titles: *Bulletin OACI* and *Boletín OACI.*

review of reviews / books

SPANISH

Mundo Electrónico. 594 Avenida José Antonio, Barcelona-7. Año 1974. N.º **26.** P. 25-32. *Jiménez Codinach J.H.* Algunos defectos comunes en la soldadura de circuitos impresos — Causas y medidas de corrección.

Revista Electrotécnica. Asociación Electrotécnica Española, Aribau 61, Barcelona. Año 1974. **Enero.** P. 81-85. *Seaborg G.T.* La energía nuclear y el medio ambiente.

Revista Española de Electrónica. Ediciones técnicas REDE, Apartado 5252, Barcelona. Año 1974. N.º **230.** P. 64-67. *Miguel B.* Antena de cuadro para VHF.

OTHER LANGUAGES

German

Elektrotechnik und Maschinenbau. Postfach 367, 1011 Wien. Jahrgang 1974. **Heft 1.** S. 18-22. *Heidner D.* Entwicklung der Modemtechnik.

Frequenz. Zeitschrift für Schwingungs- und Schwachstromtechnik, Fachverlag Schiele und Schön GmbH, 11 Markgrafenstrasse, 1 Berlin 61. Jahrgang 1974. **Januar.** S. 28-30. *Völker E.J.* Zur Akustik des Grossraumbüros — Erzeugung von verdeckendem Hintergrundgeräusch durch Lautsprecheranlagen.

Italian

Elettrotecnica (L'). Associazione Elettrotecnica ed Elettronica Italiana, 259 Viale Monza, 20126 Milano. Anno 1973. **N. 11.** P. 1083-1087. *Burchiani A.* Trasduttore di micro-spostamenti ad alta sensibilità ed alta stabilità.

Radio Industria. 115 Via Ripamonti, 20141 Milano. Anno 1973. **N. 412.** P. 37-40. *Caccia G.G.* Circuiti integrati lineari.

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Elektronikk. Hovfaret 17, Boks 235, Skøyen, Oslo 2. Årgang 1974. **Nr. 1.** S. 13-18. *Rudjord T.* Elektriske modeller i bio-medisinsk forskning.

Polish

Rozprawy Elektrotechniczne. Polska Akademia Nauk Komitet Elektrotechniki, Politechnika, Plac Jedności Robotniczej 1, 00-661 Warszawa. 1974. **Zeszyt 1.** Str. 41-58. *Choreń O., Zientalski M.* Metody oceny niezawodności systemów telekomunikacyjnych.

Roumanian

Poştă şi Telecomunicaţii. Calea Griviţei nr. 193 B, Sector 8, Bucureşti. Anul 1973. **Nr. 10.** P. 524-529. *Roth I.* Serviciul de radiodifuziune prin satelit *(I)*.

Nr. 11. P. 578-583. *Roth I.* Serviciul de radiodifuziune prin satelit *(II)*.

Nr. 12. P. 635-641. *Roth I.* Echipamente şi sisteme de radiodifuziune prin satelit *(I)*.

MULTILINGUAL

AEÜ. Archiv fur Elektronik und Übertragungstechnik — Electronics and Communication, Birkenwaldstrasse 44, Postfach 347, 7 Stuttgart 1. Jahrgang 1973. **Heft 12.** S. 497-504. *Zelinski R., Noll P.* Optimale Quantisierung gedächtnisfreier Gaussquellen — S. 511-518. *Kühn E.* A mode-matching method for solving field problems in waveguide and resonator circuits.

ELDO/ESRO Scientific and Technical Review — Revue scientifique et technique CECLES/CERS. European Space Vehicle Launcher Development Organisation/European Space Research Organisation — Organisation européenne pour la mise au point et la construction de lanceurs d'engins spatiaux/Organisation européenne de recherches spatiales, 114, avenue Charles-de-Gaulle, 92522 Neuilly-sur-Seine. Year 1973. **Nos. 3-4.** P. 213-239. *Andresen R.D., Leimann E.A.* Photomultiplier selection criteria for satellite experiments.

PTT Technische Mitteilungen — Bulletin technique — Bollettino tecnico. Entreprise des postes, téléphones et télégraphes suisses, Viktoriastrasse 21, 3000 Bern 33. Jahrgang 1974. **Nr. 2.** S. 34-46. *Wüthrich M.* Gaseinbrüche in die unterirdischen Kabelräume der Telefonbetriebsanlagen (Infiltrations de gaz dans les chambres de câbles souterraines des installations d'exploitation téléphoniques) — P. 52-57. *Nuoffer B.* La selezione a tastiera nell' apparecchio telefonico modello 70.

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books

EBU VOCABULARY FOR TELEVISION TAPE-RECORDING [1]

(EBU technical information sheet No. 4), 2nd edition, July 1973.

[1] *One paperback volume; pp. 73. 21×29 cm. Published by the* European Broadcasting Union, Technical Centre, *32 Avenue Albert Lancaster, 1180 Bruxelles, July 1973. Price : 50 Belgian francs.*

This document, which was drawn up by the European Broadcasting Union (EBU) Sub-group G2 (Television tape-recording), is sub-divided into three parts.

The first part consists of a list of terms and definitions, in English and French.

The second part consists of a multilingual lexicon, giving the terms or equivalent expressions in English, French, German, Spanish, Italian, Dutch, Danish, Swedish, Norwegian, Finnish, but does not include any definitions.

The third and final part consists of an alphabetical index of all the terms mentioned in each language.

A. El-Zanati

PM 3400 — THE SAMPLING OSCILLOSCOPE IN THEORY AND PRACTICE [2]

edited by *NV Philips' Gloeilampenfabrieken.*

[2] *One paperback volume; pp. 72; tables, diagrams, illustrations. 21×21 cm. Published by* NV Philips' Gloeilampenfabrieken, Eindhoven, *1973.*

This volume is intended to provide a clear insight into the way in which a sampling oscilloscope functions and how to derive the maximum benefits from the use of such an instrument.

The sampling oscilloscope is no more difficult to operate than a real-time oscilloscope. This book covers all aspects of operating this instrument in detail. It also sets out a number of practical exercises based on the *PM 3400* sampling oscilloscope. The principles of sampling are fully explained and solutions to the problems posed in the exercises are given at the end of the book—together with an explanation of how the results were obtained.

A. El-Zanati

2nd World Telecommunication Exhibition

(Geneva, 2-8 October 1975)

how?

TELECOM... the word conjures up memories of the most prestigious world telecommunication exhibition, which exemplified the extraordinary progress in electronics that mankind is witnessing during this second half of the 20th century. At a time when all countries are equipping themselves for the new technological age, it is most important for those who run our telecommunications to keep abreast of the latest advances. The constant development of equipment calls for a sustained effort, even among specialists, to keep informed. The acquisition of modern equipment generally necessitates long, frequent and costly journeys; by bringing official bodies and the telecommunication industry together under the same roof, the ITU will be giving all professionals in telecommunications, sound and television broadcasting, and users too, a unique opportunity of surveying the whole field of systems, networks and markets.

Thus, the fruitful contacts begun during TELECOM 71 can be renewed between exhibitors: administrations, manufacturers of systems and components and the visitors: senior members of telecommunication organizations from all parts of the world, engineers, the specialized press and participants in the second session of the Regional Administrative Radio Conference for LF/MF Broadcasting (in Africa, Asia, Australasia and Europe), to be held in Geneva during that time.

With the theme " TELECOMMUNICATIONS = PROGRESS ", this exhibition can help promote the economic and social advancement of our world, for it is by now a truism that this advancement goes hand in hand with the development of telecommunications of every kind.

why?

At the invitation of the Swiss Government, for seven days from 2 to 8 October 1975, the international city of Geneva will become the capital of world telecommunications, since TELECOM 75 will attract the representatives of all sectors of telecommunication activity.

TELECOM 75 will be the largest and most comprehensive exhibition of its kind. The services and equipments and components on show will cover all aspects of terrestrial and satellite telecommunications: sound broadcasting, television, radiocommunication, telephony, telegraphy, and the processing and transmission of data. This second World Telecommunication Exhibition will be accompanied by the second World Telecommunication Symposium, lasting four days and dealing with the latest scientific and industrial achievements in all areas of telecommunications, including broadcasting, television and electronics.

In this way, thanks to TELECOM 75, the specialists present in Geneva will be able in a few hours to judge the capacity of the telecommunication world to meet the constantly growing demand for new techniques and equipment in the spheres of networks, data processing and transmission, and mass communication. In the *Palais des expositions*, where the famous Geneva International Motor Show is held, with its vast halls covering 50 000 square metres, the participants in TELECOM 75 will have all the necessary facilities for an exhibition on a world-wide scale.

Orgexpo, a foundation for the organization of exhibitions, run by representatives of international organizations, the Swiss Government and industry, will be responsible for the practical arrangements for TELECOM 75, as it was for TELECOM 71.

TELE
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75

Geneva, 2-8 October 1975

Closing date for applications
1 October 1974 *

*Important: The attention of exhibitors is drawn to the fact that, under the rules of the exhibition, the stands will be allocated in order of receipt of the application for admission.

The cost per square metre is
140 Swiss francs.

Dear Sirs,

I wish to reserve an area of .... square metres at TELECOM 75.

It is understood that you will confirm this request by sending us the relevant forms of application for admission, together with the additional information we shall need to study the arrangements in detail.

(Please type or print the entries on this form)

Name: .... Function: .... Date: ....

Organization/Company: .... Street: ....

City: .... Country: ....

The following individuals, companies or organizations are likely to be interested in TELECOM 75 and the relevant documentation:

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Completion of this reply card shall not be regarded as constituting a formal commitment either for the company concerned or for the International Telecommunication Union.

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TELE
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75

Geneva, 2-8 October 1975

HOW TO WRITE NEWS FOR BROADCAST AND PRINT MEDIA [6]

by David Dary.

This volume begins with a summary of the history of journalism, from the developing of printing and the first newspapers, to the advent and growth of electronic journalism, emphasizing the similarities between print and broadcast and explains how each has grown over the years to the point where the only difference now is in the manner of delivery.

The concept of " news "—the meaning of the term and its nature—is thoroughly discussed, including the definitions of what is news and what is not, and the classification of news. A reporter's qualifications are clearly defined, as are the methods used to gather news. The author tells where news comes from, and lists many sources of local news. He explains and illustrates how to conduct an interview successfully, and how to get the most out of a news conference. The use of two-way radio, monitor receivers, and other electronic devices is also covered. Extensive detail is devoted to the syntax of the news sentence, the paragraph, and word selection. Each part of the story is discussed, as is the relationship of each to the overall impact of its presentation.

For those interested in broadcast journalism, there is a chapter devoted exclusively to writing for radio and television; it covers the basic techniques, and tells how to handle various story elements in a way the listener will understand. Other chapters are on the feature story, editing news copy, and the law as it relates to news reporting.

A. El-Zanat

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[6] *One bound volume; pp. 192; illustrations. 15×22 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1973. Price: 9.95 US dollars.*

tenders

We should be obliged if any administrations wishing to make use of this column would send us their tenders if possible three months before the closing date for bids.

REPUBLIC OF THE SENEGAL

An international invitation to tender is hereby issued for the supply and installation of equipment required to **modernize the northern route of the national network**, i.e. Dakar—Thiès—Saint-Louis—Bakel, and to **expand the Dakar underground telephone network**, the work to be carried out under a loan from the International Bank for Reconstruction and Development (IBRD).

The project comprises the following major operations:

— installing radio-relay links of various capacities on the Dakar—Thiès—Saint-Louis—Richard Toll and Richard Toll—Podor—Matam—Bakel routes;

— modernizing and fitting carrier current equipment to the Thiès—Louga—Saint-Louis and Louga—Lingueré overhead trunk lines;

— installing automatic telephone exchange equipment at Dakar, Kébemer, Louga, Saint-Louis, Richard Toll, Dagna, Podor, Matam and Lingueré;

— fitting out the Thiès exchange and various other exchanges;

— expanding the underground telephone networks in Dakar, Saint-Louis and other towns mentioned earlier.

The various supplies and work required are detailed in individual sets of specifications making up a series of 11 booklets.

Interested firms may obtain the complete series of specifications from: " Direction de l'Office des postes et télécommunications (OPT), Division des télécommunications, 2^e bureau (pièce 228), 6, boulevard Roosevelt, Dakar (Sénégal) " on payment of 50 000 (fifty thousand) CFA francs by postal or bank cheque made out to: " M. l'agent comptable de l'OPT. "

Tenders should reach the same address by 10 June 1974 at the latest, using one of the following two procedures:

1) proposals deposited by bearer in *two* sealed envelopes:

— the first carrying the address given above and the inscription: " Confidentiel; proposition de prix; projets Dakar + axe Nord ",

— the second carrying no inscription and containing the documents.

It should be noted that diplomatic representatives in Dakar may act as intermediaries in this procedure;

2) proposals sent by post in *three* sealed envelopes:

— the first carrying the address of the addressee (OPT),

— the second carrying the inscription: " Confidentiel; proposition de prix; projets Dakar + axe Nord ",

— the third carrying no inscription and containing the documents.

Tenders may be filed by any firm belonging to a Member country of the IBRD or to Switzerland.

GREECE

Tender No. 7071

Tenders are invited by the Hellenic Telecommunications Organisation SA (OTE) for **supply of material and equipment for VHF and UHF radio links.**

Closing date for tenders is 24 May 1974.

For more detailed information, the firms interested may refer to the following address: " Hellenic Telecommunications Organisation SA, Call for Bids Division, 6 Klissovis Street (2nd floor—room 24), Athinai 141, Greece ".

official announcements

CHANGE OF DENOMINATION

The official name of Burma has been changed from " Burma (Union of)" to **Burma (Socialist Republic of the Union of).**

INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE COMMITTEE (CCITT)

With the approval of the Administration of the United States, **Anaconda Telecommunications, Anaheim (California)** and **Computer Transmission Corporation, El Segundo (California)** have been admitted to take part in the work of the CCITT as industrial organizations.

With the approval of the French Administration, the **Société Datatel, Boulogne-Billancourt (Hauts-de-Seine),** the **Société Kalle Intofec, Nanterre (Hauts-de-Seine)** and the **Société Rank Xerox, Puteaux (Hauts-de-Seine)** have been admitted to take part in the work of the CCITT as industrial organizations.

TECHNICAL CO-OPERATION

Recruitment of experts

A circular-letter which has been sent to all Members of the Union announces the following vacancy:

- one post of **telecommunications adviser,** to be filled as soon as possible, for two years, for the Federal Ministry of Communications of the United Arab Emirates. Duty station: Abu Dhabi, with travel to other parts of the Emirates. (Circular-letter No. 459 of 7 February 1974; field vacancy notice TC 10/74 UAE-500; final date for submission of applications: 2 May 1974).

Only applications forwarded through administrations can be taken into account. Detailed applications with personal histories should be submitted to the General Secretariat of the ITU, Place des Nations, 1211 Geneva 20 (Switzerland), not later than the final date mentioned above.

CALENDAR OF ITU CONFERENCES AND MEETINGS

DATE	TITLE	PLACE
1974	**International Radio Consultative Committee (CCIR):**	
15-26 July	**XIIIth Plenary Assembly**	**Geneva**
	International Telegraph and Telephone Consultative Committee (CCITT):	
1-5 April	Regional Tariffs Party TEUREM (Tariffs—Europe and the Mediterranean Basin)	Geneva
1-5 April	Working Party IV/5 (Maintenance of groups, supergroups, etc., and of new systems)	Geneva
1-11 April	Study Group Special D (Pulse code modulation)	Geneva
8-11 April	Working Party IV/4 (Stability of the international network)	Geneva
24-26 April	Study Group XIV (Facsimile telegraph transmission and equipment)	Geneva
29 April-3 May	Study Group IX (Telegraph transmission quality; specification of equipment and rules for the maintenance of telegraph channels)	Geneva
6-10 May	Study Group X (Telegraph switching)	Geneva
6-10 May	Joint Working Party LTG (Use of telephone-type lines for purposes other than telephony)	Geneva
6-10 May	Working Party XI/6 (Signalling System No. 6)	Copenhagen
9-15 May	Working Party XI/3 (Programming languages)	Geneva
20-24 May	Working Party IV/1 (Maintenance of telephone-type circuits)	Geneva
27-31 May	Working Party IV/2 (Measuring equipment)	Geneva
3-7 June	Working Party II/1 (International accounting)	Geneva
10-14 June	Working Party III/1 (Leased circuits)	Geneva
8-12 July	Joint Working Party CDF (Protection against lightning)	Geneva
2-9 September	Plan Committee for Europe and the Mediterranean Basin	Spain

DATE	TITLE	PLACE
16 September-4 October	Working Parties of Study Group XI (Telephone switching and signalling) and Working Parties XIII/1 (Maintenance (switching) and service quality) and XIII/2 (Network planning and traffic engineering)	Geneva
2-22 October	Study Group XII (Telephone transmission performance and local telephone networks) Study Group XVI (Telephone circuits) Joint Study Group Special C (Noise and reliability)	Munich
7-18 October	Working Parties of Study Group I (Telegraph operation and Tariffs—including telex)	Geneva
23-30 October	Plan Committee for Asia and Oceania	Tokyo
	Joint Study Groups of the two CCIS:	
	Special C (see under CCITT) Plan Committees (see under CCITT)	
22 April-7 June	**World Administrative Radio Conference for Maritime Mobile Telecommunications**	**Geneva**
15 June-5 July	**29th Session of the Administrative Council**	**Geneva**
7-25 October	**Regional Administrative Conference for LF/MF Broadcasting (First Session)**	**Geneva**
	Seminars:	
	■ **International Frequency Registration Board (IFRB):**	
9-20 September	Frequency management and use of the radio frequency spectrum	Geneva
	■ **Technical Co-operation Department:**	
21-30 April	Planning of broadcasting systems	Kuwait
14-24 May	Working Group on training standards	Geneva

ITU publications

The following letters indicate the languages in which documents are published

F *for French*	**R** *for Russian*
E *for English*	**C** *for Chinese*
S *for Spanish*	

Prices are in Swiss francs.

Note

A comprehensive list of all the publications of the Union will be supplied free on request by the ITU General Secretariat, Geneva.

Publications issued since the last number of the Journal

IFRB

International Frequency Registration Board

Tentative high frequency broadcasting schedule — May schedule 1974 J (1974)

Period: 5 May-1 September 1974

Trilingual edition **F,E,S.**

Summary of monitoring information received by the IFRB

No. 180 (30 September 1973-2 February 1974)

Trilingual edition **F,E,S.**

ITU publications

Forthcoming publications

International Telecommunication Convention (Malaga-Torremolinos, 1973)
Separate editions in **F, E, S, R, C.**

Optional Additional Protocol on the Compulsory Settlement of Disputes (Malaga-Torremolinos, 1973)
Separate editions in **F, E, S, R, C.**

Minutes of the Plenary Meetings of the Plenipotentiary Conference at Malaga-Torremolinos, 1973
Separate editions in **F, E, S.**

High frequency broadcasting schedules (4 publications per annum)
Trilingual edition **F, E, S.**

List of coast stations (List IV), 5th edition, 1972
Trilingual edition **F, E, S.**

List of space radiocommunication stations and radio astronomy stations (List VIIIA) 4th edition, 1973
Trilingual edition **F, E, S.**

Final Acts of the World Administrative Telegraph and Telephone Conference (Geneva, 1973)
Separate editions in **F, E, S.**

Seminar on the planning of broadcasting systems in Africa (Lagos, 1971)
Separate editions in **F, E.**

Seminar on frequency management (Mexico City, 1971)
Separate editions in **E, S.**

Summary of monitoring information received by the IFRB
No. 181 (February-June 1974)
Trilingual edition **F, E, S.**

Seminar on the planning of broadcasting systems (São Paulo, 1973)
Separate editions in **E, S.**

List of international telephone routes, (14th edition)
Trilingual edition **F, E, S.**

List of ship stations (List V), 14th edition, 1974
Trilingual edition **F, E, S.**

Instructions for the operation of international public telegram service, 1974 edition
Separate editions in **F, E, S.**

CCITT
International Telegraph and Telephone Consultative Committee

Vth Plenary Assembly, Geneva 1972

Green Book

Volume VI—Recommendations (Series Q) and Questions (Study Groups XI and XIII) relating to telephone signalling and switching (signalling system included)
Separate editions in **F, E, S.**

General plan for the development of the regional telecommunication network 1972-1974-1976-1982 (Brasilia, 1973)
Trilingual edition **F, E, S.**

Selected CCITT Recommendations relating to international sound and television programme transmissions, 1974 edition
Separate editions in **F, E, S.**

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Methods of payment:

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   - *b)* UNESCO coupon,
   - *c)* bank transfer to the Société de Banque Suisse, Geneva.

(Payment may also be effected by a cheque made out in another currency freely convertible into Swiss francs provided that the cheque, when cashed and converted, will cover the price of the publication in Swiss francs.)

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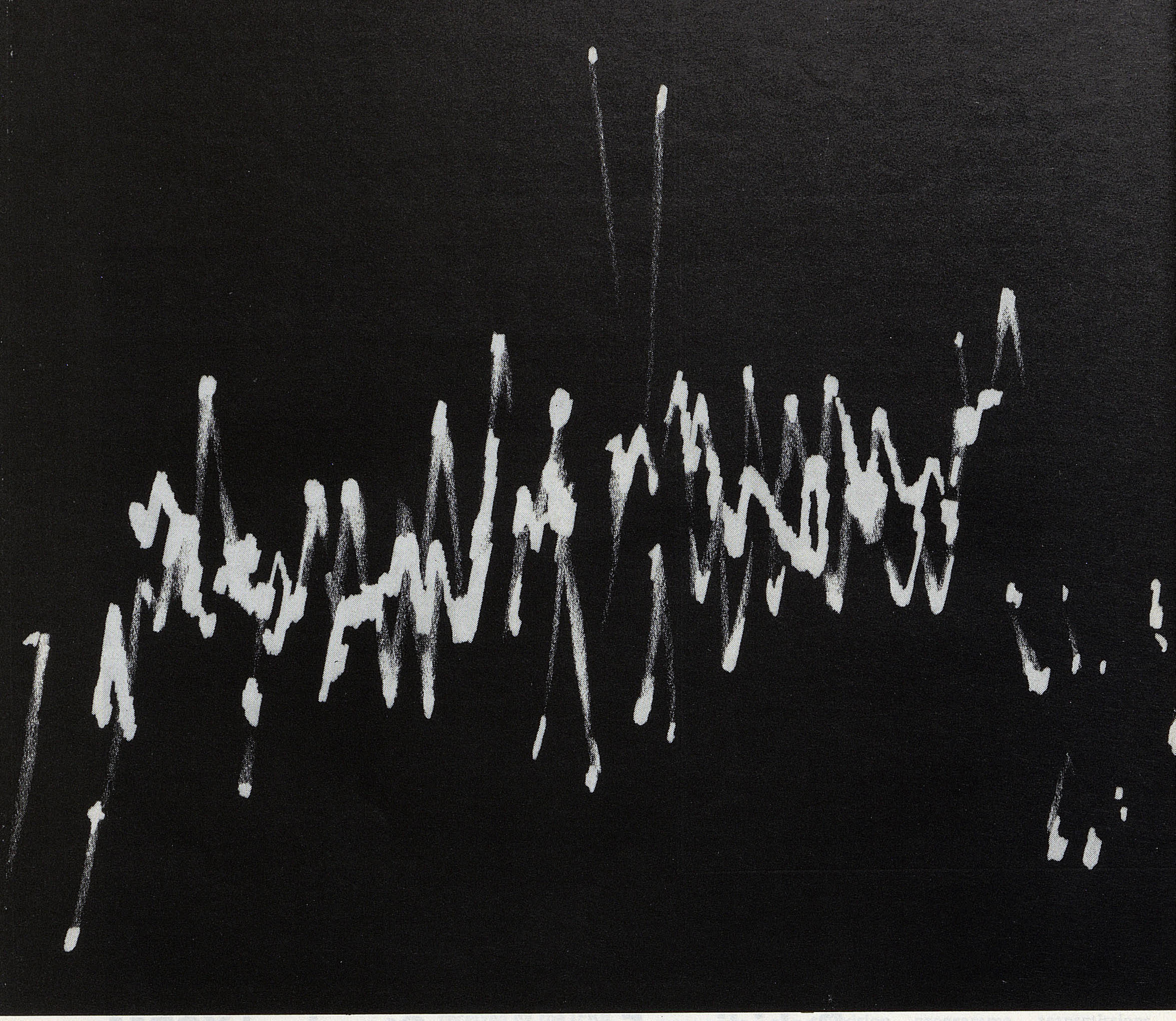

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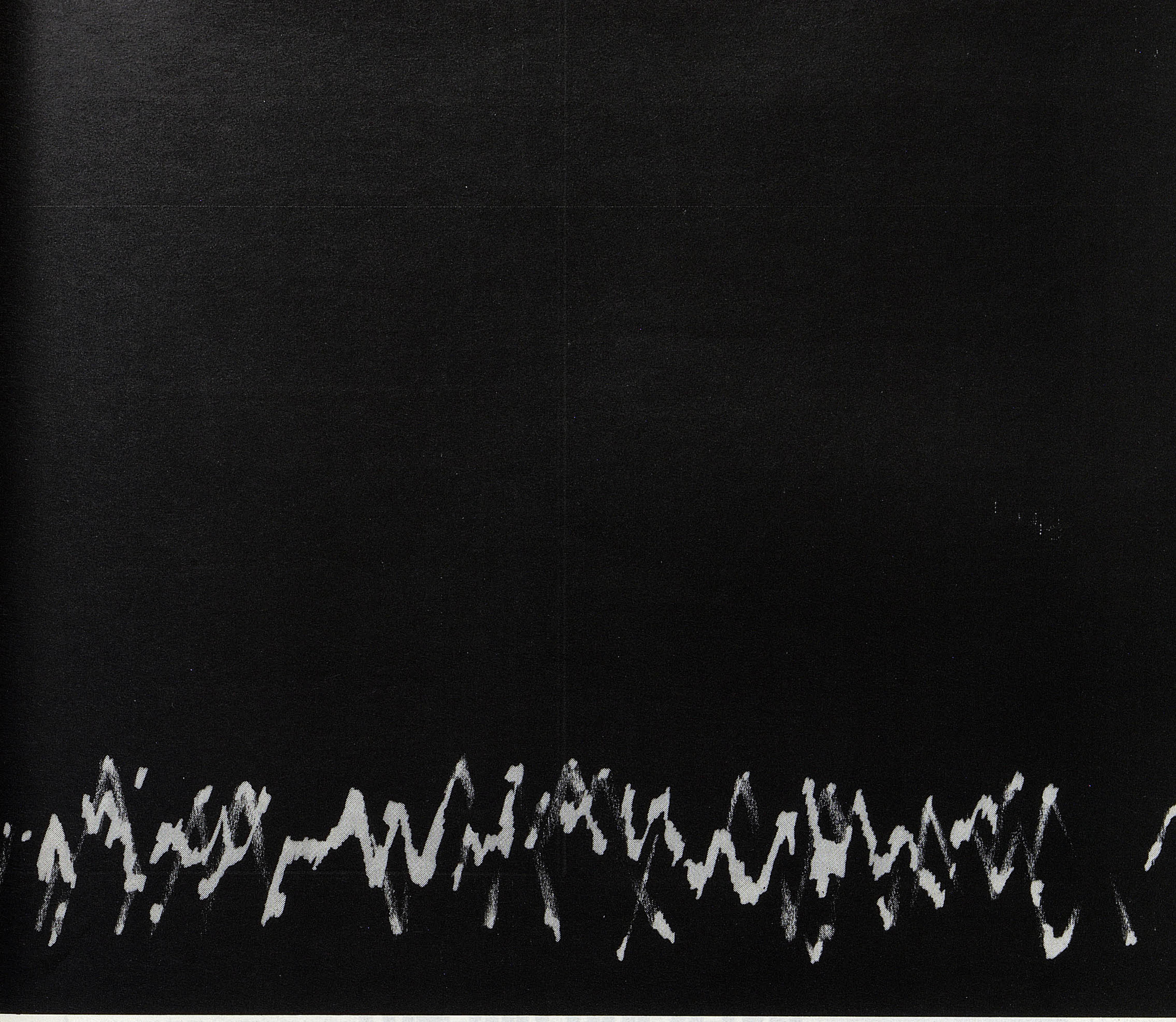

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The CTR-142. 12,700 to 13,250 MHz. 960 FM channels or 480 PCM channels. Its 9.5 dB rating is outstanding for a transceiver operating at such high frequencies.

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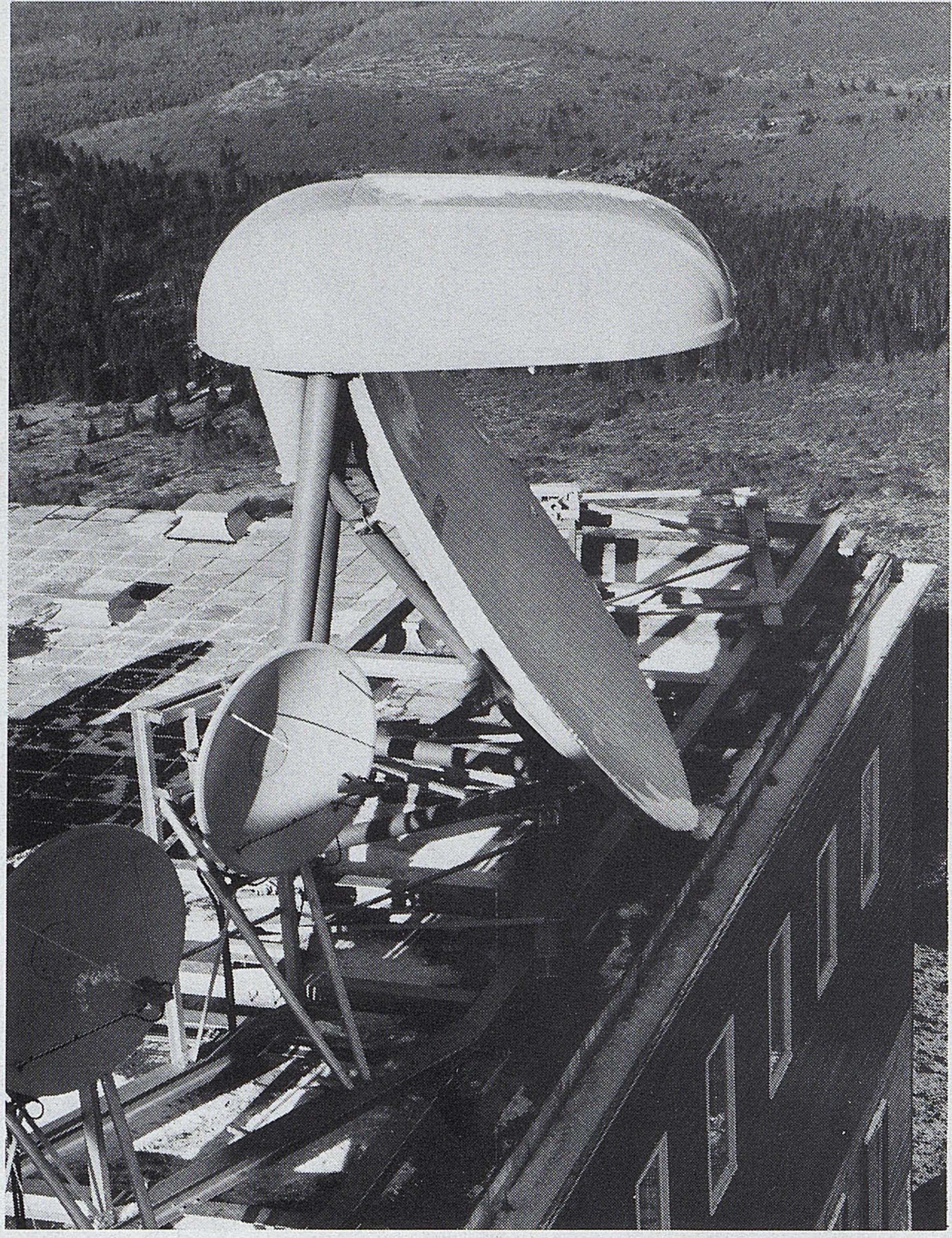

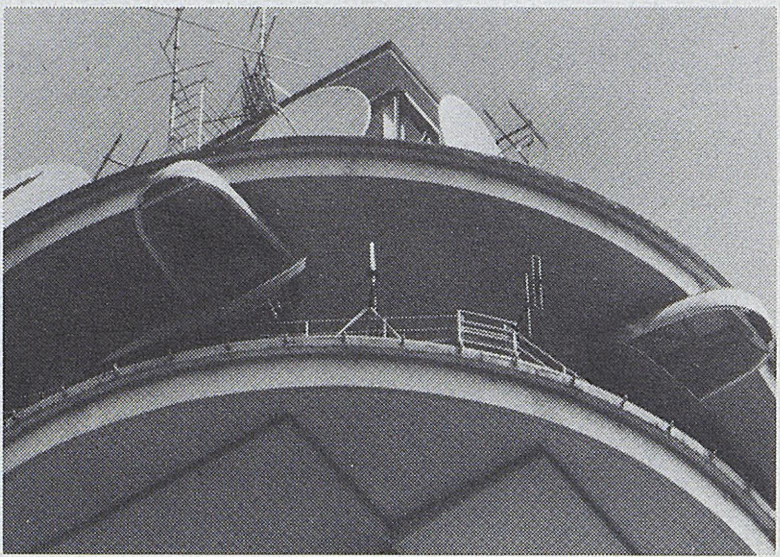

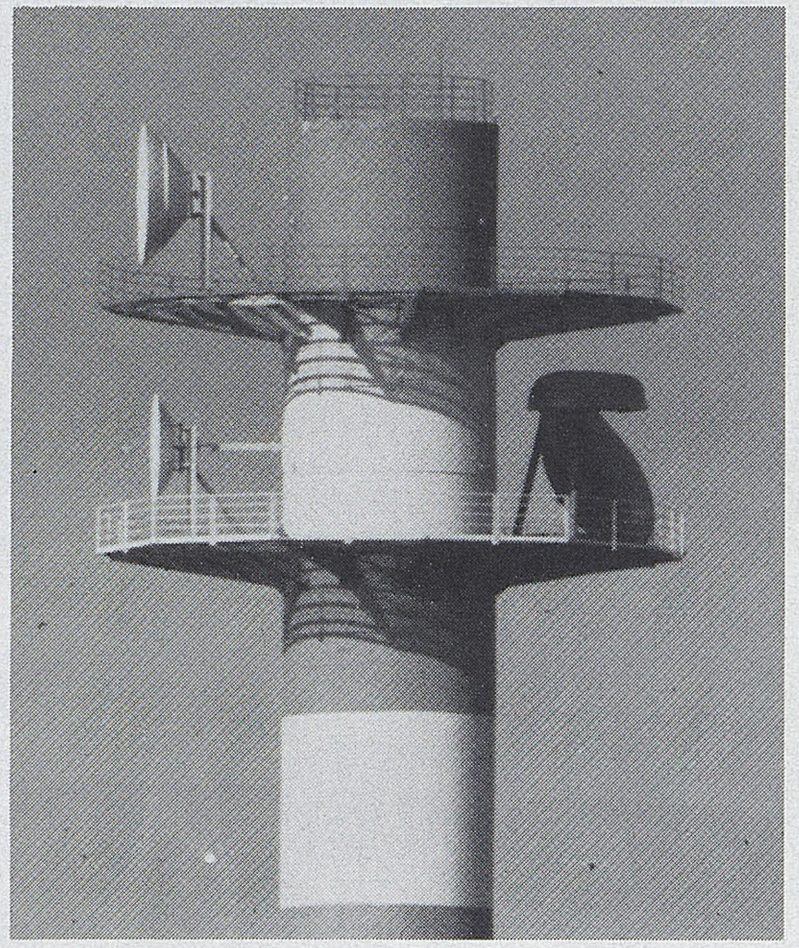

SINCE DECEMBER 72

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bears out the highest performances
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1859

Are you responsible for high quality transmission of telephone, videophone, voice telegraph and data signals?

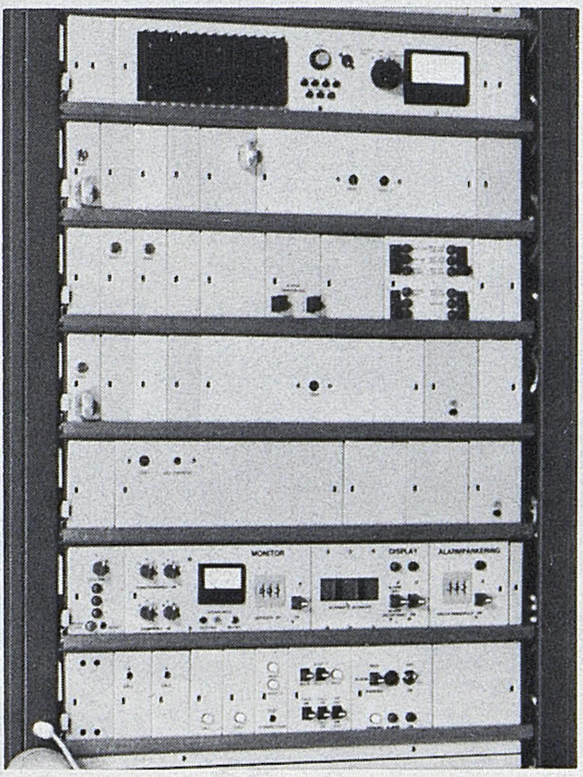
Delegate that responsibility to ITT's 12 MHz line equipment!

As part of your organisation the ITT 12 MHz line equipment will undoubtedly be a working-partner you can trust. Complying with all applicable CCITT recommendations, this is a product of advanced technology and high reliability. With wired subracks and profiled bayside racks in ISEP construction. Easy to install and easy to extend with additional systems to meet future demands. Good accessibility and plug-in units mean simplified maintenance. Dependent repeaters of robust and compact design. Repeater housing suitable for installation independent of local terrain. Line loss variation compensated by a combination of fixed gain and pilot regulated repeaters.

This principle of level regulation also makes it possible to operate with aerial suspended cable.

Main Data	
System Capacity	2700 telephone channels over two coaxial tubes
Transmission Media	CCITT main core (2.6/9.5mm) or small core (1.18/4.43 mm) coaxial cables
Bayside Dimensions Max. Capacity	225×600×2.743mm 3 complete systems
Repeater Housing	Diam. 680 mm Height 1120 mm Capacity for 3 systems
Nominal Repeater Spacing	4.5 km (2.6/9.5 mm) 2 km (1.18/4.43 mm)
Power feed section	Max. 30 repeaters (31 repeater sections)
Attenuation distortion	≦ 1dB
Level stability	Better than ±1dB
Noise	1.0 pW/km (2.6/9.5 mm) ≦3.0 pW/km (1.18/4.43 mm)

For further details contact the ITT company in your local area or Standard Telefon og Kabelfabrik A/S, P.O. Box 60, Økern, Oslo 5, Norway.



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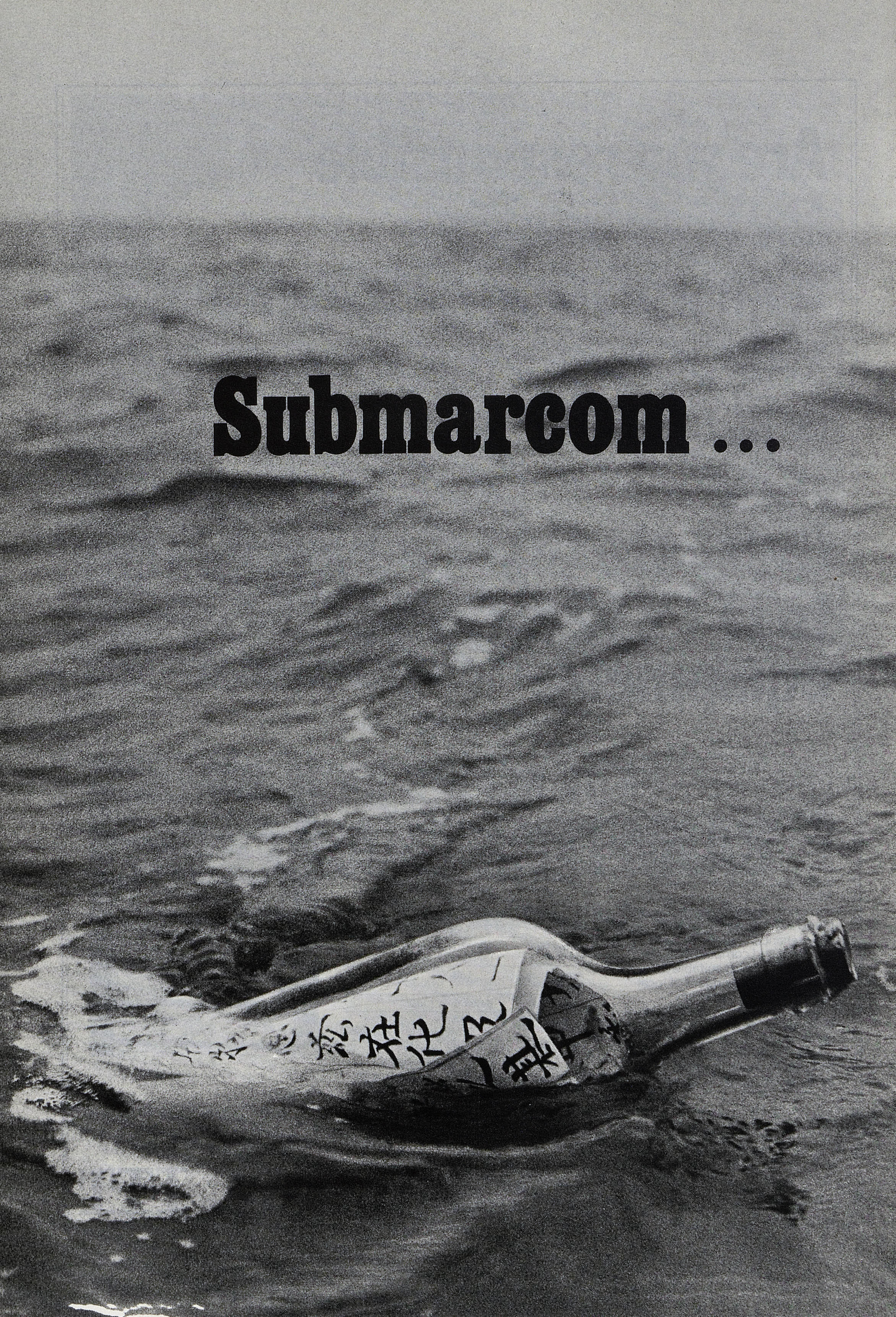

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Pioneers in submarine
telecommunications since 1890,
we installed our first telephone link in 1950.
We shall soon be notching up 25,000 kilometres
of undersea cable, equal to 10 million
kilometres of telephone circuits laid
end-to-end. The repeaters have already put in
nearly 20 million service hours.
Submarcom is now installing 3440-channel
links to connect up France with Italy and the
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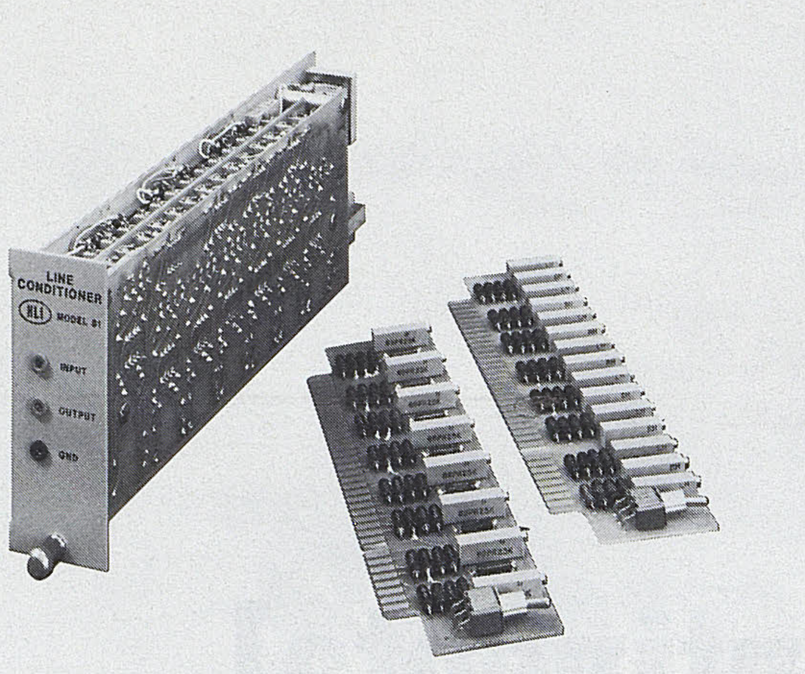
Promotion Vente Publicité 1048

LINE CONDITIONER WITH A MEMORY



allows line conditioner replacement without circuit re-equalization

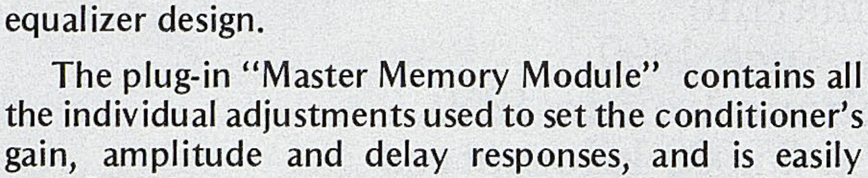
The Model 81 Line Conditioner represents the latest innovation in telephone channel amplitude and delay equalization equipment. It combines extended equalization range, a unique plug-in "Master Memory Module" and exceptionally small size in an amplitude and delay equalizer using the proven "ISO-COMP" equalizer design.

The plug-in "Master Memory Module" contains all the individual adjustments used to set the conditioner's gain, amplitude and delay responses, and is easily transferred to a replacement conditioner. Transferring the module to the replacement conditioner provides a nearly identical response which eliminates the need to re-equalize the voice channel.

Fourteen "ISO-COMP" equalizer sections provide extended range coverage in 200 Hz steps for maximum band-edge correction. A model with "proportional spacing" is available which further concentrates equalization power at the band edges.

Delay only, or amplitude only, equalization can also be provided by plugging in either of two optional "Master Memory Modules".

Twelve Model 81's may be mounted in a single 3½" high rack shelf. An attractive table case for one or two Model 81's complete with AC power supply is also available.



MEMBER CCITT

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ITT Type 2400 Indoor Paystation: your money-maker.

The ITT Type 2400 indoor paystation has been especially designed for use in hotels, restaurants, cafés stores, groceries, etc., i.e. in all places regularly attended by public. For the public place owner the ITT Type 2400 indoor paystation means better service to his customers and represents a profitable investment.

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That is why the ITT Type 2400 indoor paystation is a real money-maker both for the telephone administration and the public place owner.

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Ferranti microwave links are used in air-traffic control, tv transmission, port surveillance and P.T.T., public-utility and private-user networks.

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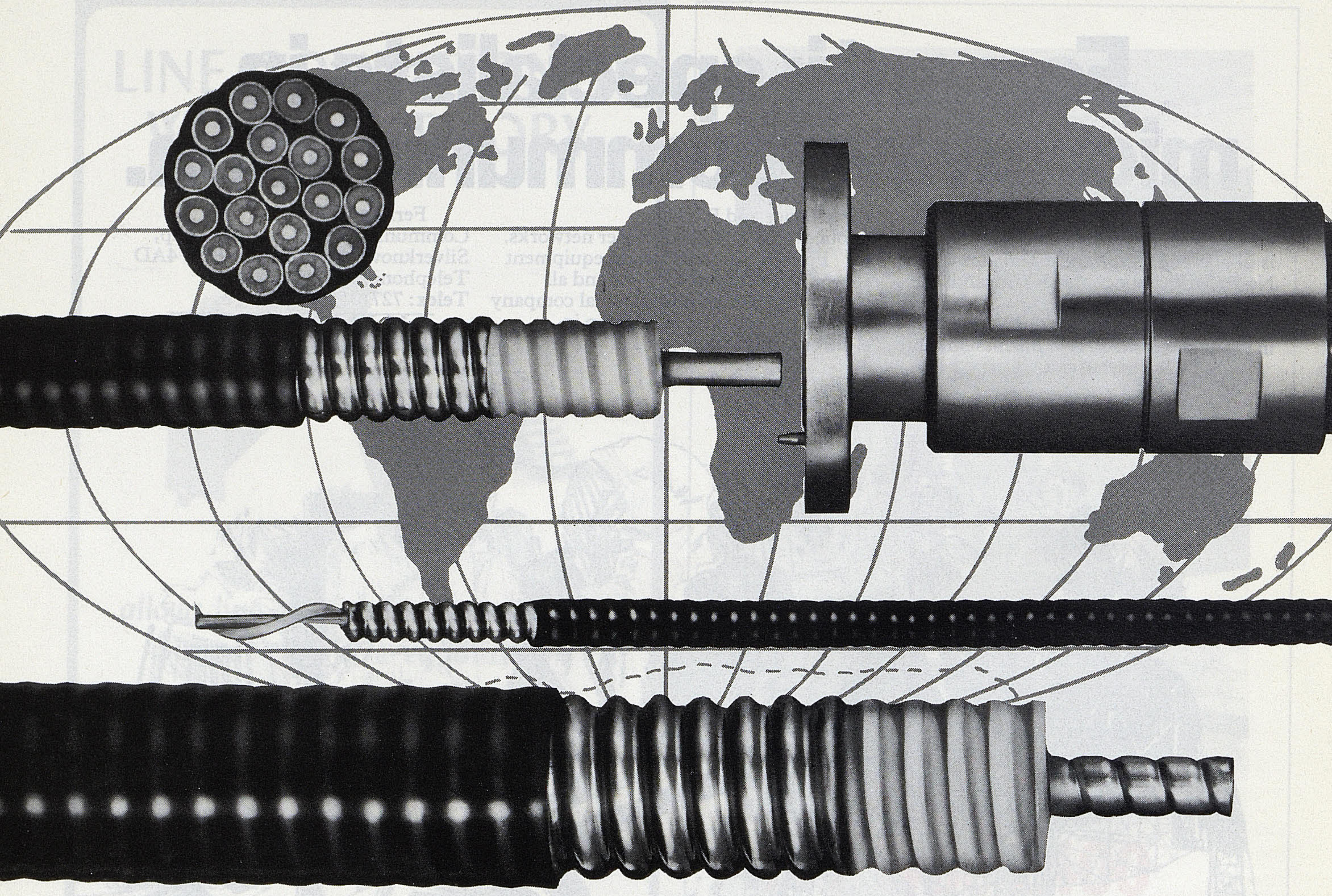

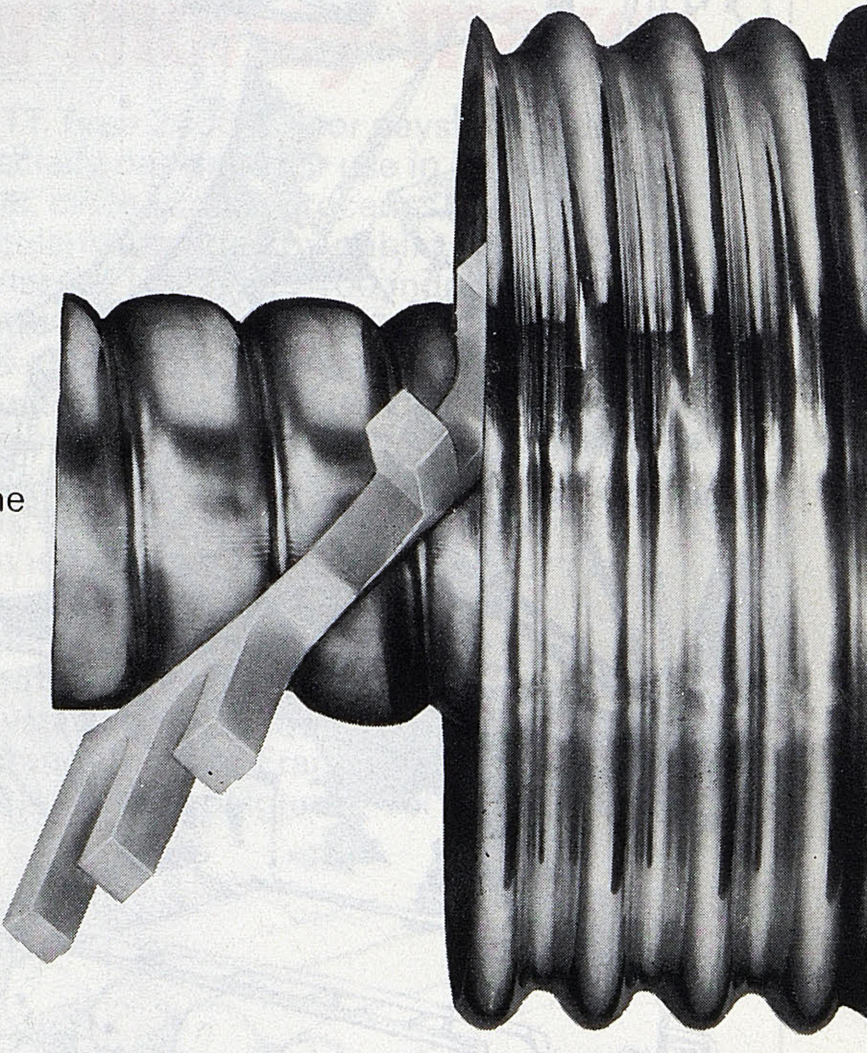

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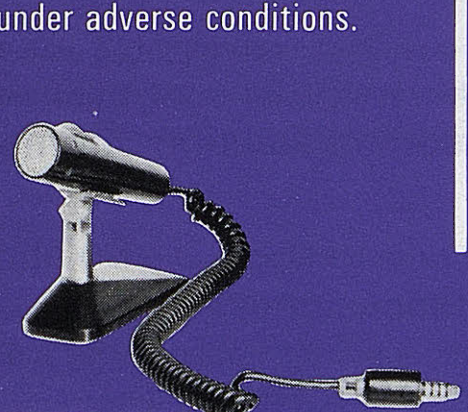
The small family of big selling transceivers.
Steadily winning an international reputation in those places where reliability and performance are vital.
Ideal for engineering links and temporary point to points.

Solid State – Six integrated circuits. A single commercial transmitting tube in final PA only.

APPLICATION

The AEL 3015 single channel SSB transceiver is designed for reliable long distance voice communications. The transceiver is completely self contained and only requires connection to the antenna and power source for operation.

The equipment has a power output of 60 Watts P.E.P. and will provide the same communications effectiveness as a 500 Watt AM transmitter when operating under adverse conditions.



HF SSB voice manpack transceiver SC120UL

APPLICATION

★ 1–23 channel
★ Selectable Side Bands
★ 2MHz–10MHz
★ Self-contained re-chargeable batteries
★ External AC or DC supplies
★ Radio Telephone or Telegraphy
★ (A3J–A3H–A1CW) no circuit alignment, just fit crystals and tune PA/Antenna.

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The equipments have been designed for use in rugged humid environments and are resistant to vibration and shock, equally suitable for operation in the tropics or the arctic regions.

Solid State – ten integrated circuits Commercial transmitting tubes in final PA and driver only.

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Please send for detailed technical brochures.

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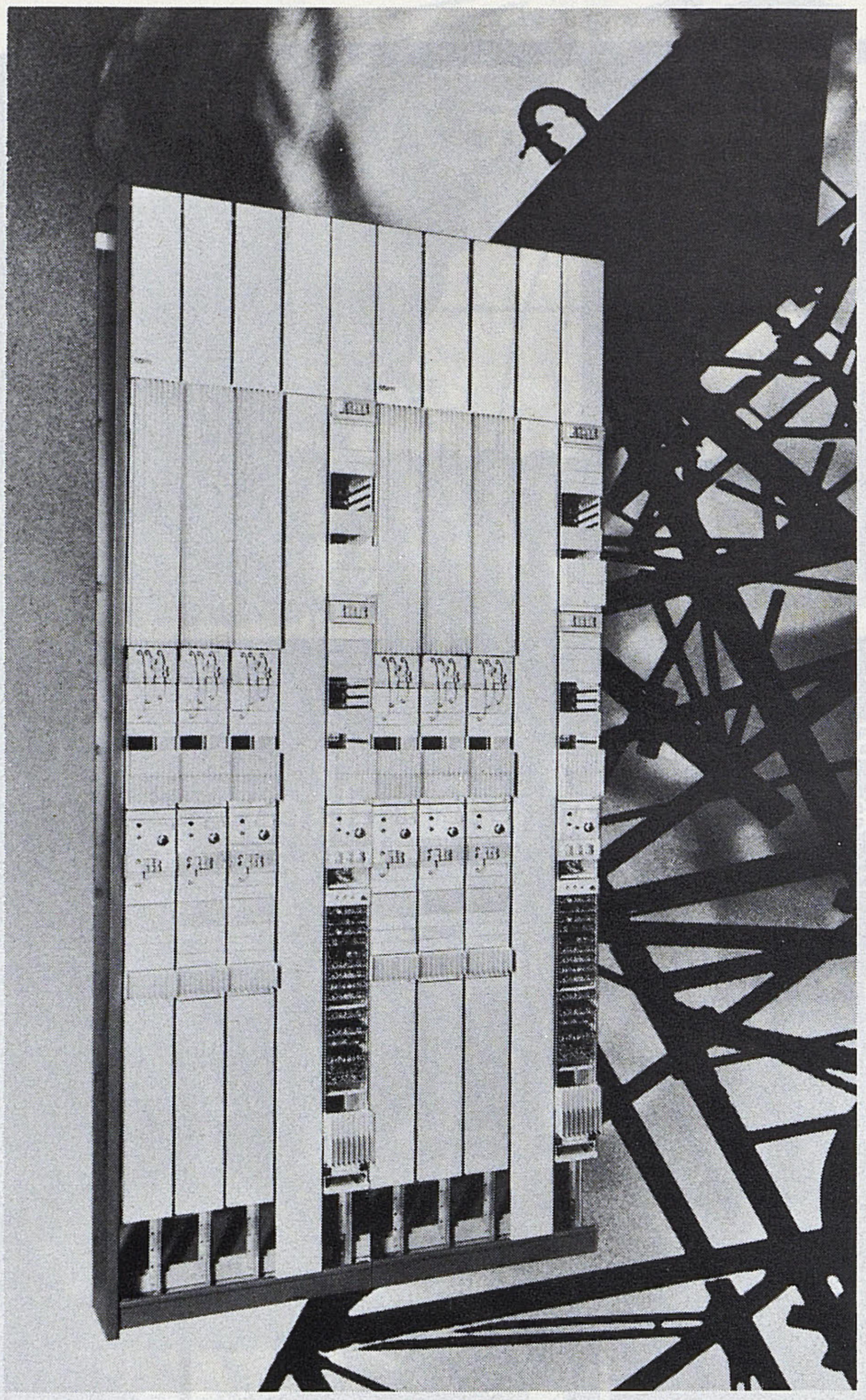

1260 channels microwave radio all solid state.

For transmission of 960 or 1260 channels FDM, or a Colour TV signal at 6 GHz with 2 Watts transmitter output power, or at 7 GHz with 1·5 Watts.

Leak and insert in IF through repeaters for up to 120 channels wayside traffic independent from main traffic.

Auxiliaries:
- IF and baseband switching
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Designed in ITT's new transmission equipment practice, called VSEP (Vertical Standard Equipment Practice) the RR-System allows a high degree of flexibility and wide extension possibilities of station lay-out.

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Line and Radio Transmission Division
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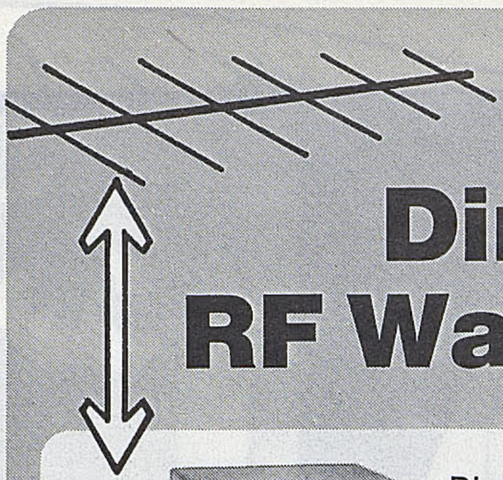
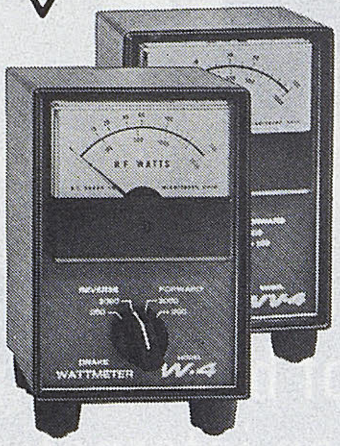
Bell Telephone Mfg Co ITT





DRAKE Directional RF Wattmeters

Directional, through line, highly accurate wattmeters employ printed circuits and toroids. Continuous monitoring of antenna performance and either forward or reflected power for fast accurate tune up. Indirectly measure radiated power (forward minus reflected) and VSWR using nomogram included. Use to adjust antenna resonance and impedance match. Removable coupler.

Specifications		W-4	WV-4
Frequency Coverage		1.8-54 MHz	20-200 MHz
Power Capability (cont. duty)	Hi Range	2000 W	1000 W
	Lo Range	1000 W	100 W
Accuracy of Reading		± (5% + 1% of full scale)	
Line Impedance		50 Ohm resistive	
VSWR Insertion		no more than 1.05:1	
Size		14.0 x 9.5 x 10.2 cm	

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Développez vos contacts avec les responsables des réseaux de télécommunication dans le monde en intensifiant votre publicité dans le «Journal des télécommunications».

To build up your contacts with those who count in world telecommunications advertise more in the "Telecommunication Journal".

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OKI Electric's Microwave Radio Relay System

Outstanding development of electronics technology has promoted and met the progress of society and higher level of industry, which require further development of long-distance transmission techniques to enable faster dispatch of larger volumes of information such as voice, data and video.
In this field, Oki Electric has marketed a variety of microwave communication equipment.
The products of Oki Electric have major characteristics as follows:

- All-solid-state
- High reliability assured by strict quality control
- Compact and economical design
- Simple operation and easy maintenance
- Conformity to all CCIR Recommendations
- Both materials and labor needed for the construction of a station have been largely reduced with the use of a shelter housing method, and the construction period has been shortened.
- Streamlined system with scientific management

Consultations for the designing of communications systems are cordially welcomed by Oki Electric.

OKI electric industry co., ltd.
SINCE 1881
10-3, Shibaura 4-chome, Minato-ku, Tokyo 108, Japan
Tel: Tokyo 454-2111 Telex: J22627 Cable: "OKIDENKI TOKYO"
Overseas Offices: New York, Ft. Lauderdale, Mexico City,
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Main Products: Telephone & Telex Systems, Multiplex Transmission Systems, Radio Communications Equipment, Computers (OKITAC) & Peripherals, Data Communications Systems, Telemeter & Telecontrol Systems, Marine Equipment, Electronic Components, Other Applied Electronic Equipment.

Mitsubishi Electric brings the costs of satellite communication down-to-earth.

Save on supporting equipment
Mitsubishi Electric manufactures total integrated systems of satellite communications, including ground communications equipment that fully meets — and often exceeds — ICSC and CCIR specifications.

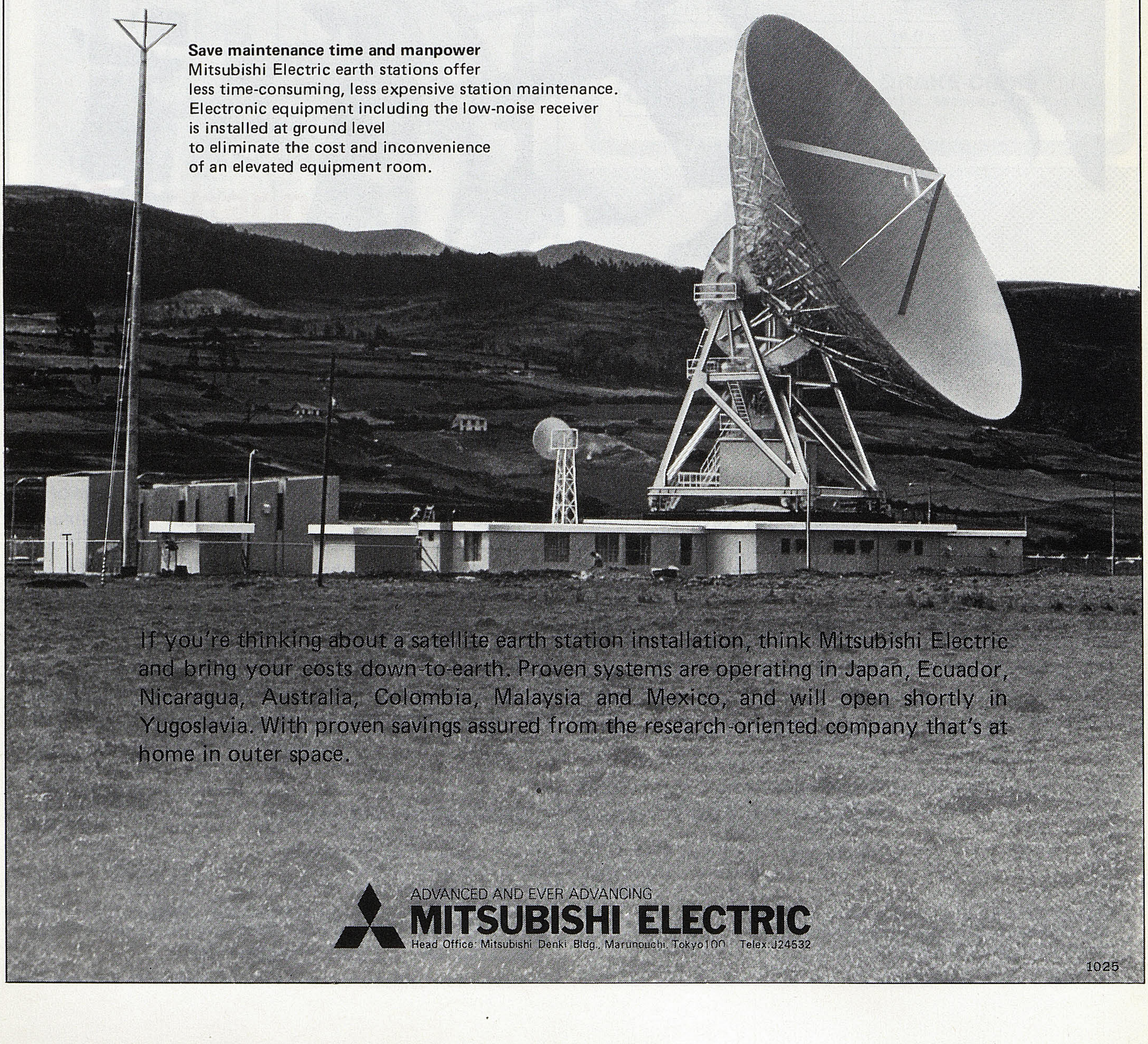
Save delivery time
Mitsubishi Electric promises faster delivery of all its advanced earth station technology. Which means proven savings over the long-and-short run.

More savings from Mitsubishi reliability
We'll install, operate and maintain earth stations to meet your individual requirements. Provide factory and on-site personnel training. And also perform site and feasibility studies.

Save installation time
Electronic equipment installation proceeds simultaneously with antenna construction. You're in operation sooner, earning revenue sooner.

Save operations expense
Mitsubishi Electric offers proven reductions in overall station operation cost. As well as significant financial guidance and assistance for this major investment.

Save maintenance time and manpower
Mitsubishi Electric earth stations offer less time-consuming, less expensive station maintenance. Electronic equipment including the low-noise receiver is installed at ground level to eliminate the cost and inconvenience of an elevated equipment room.



If you're thinking about a satellite earth station installation, think Mitsubishi Electric and bring your costs down-to-earth. Proven systems are operating in Japan, Ecuador, Nicaragua, Australia, Colombia, Malaysia and Mexico, and will open shortly in Yugoslavia. With proven savings assured from the research-oriented company that's at home in outer space.

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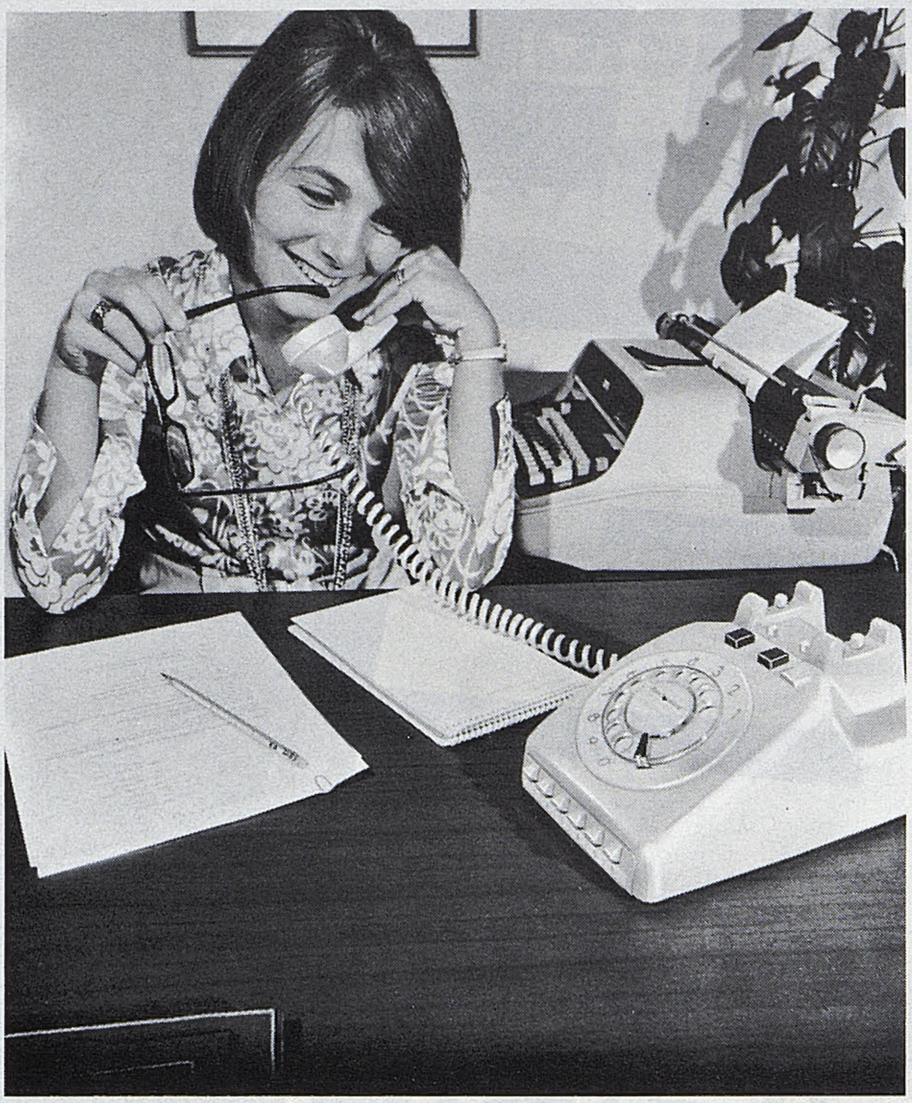

1/5 2/7 2/11 4/11
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INDEX TO ADVERTISERS

Annonceurs	*N°*
ADRET ELECTRONIQUE, Trappes (France)	*a43*
AERO ELECTRONICS LIMITED, Horley (England)	*a39*
ANDREW CORPORATION, St. Orland Park (Illinois — USA)	*a38*
CABLE & WIRELESS, London (England)	*a4*
CIT-ALCATEL, Paris (France)	*a34-35*
DATABIT INCORPORATED, Hauppauge (New York — USA)	*c4*
R. L. DRAKE COMPANY, Miamisburg (Ohio — USA)	*a40*
FERRANTI LIMITED, Silverknowes (Edinburgh — England)	*a37*
FUJITSU LIMITED, Tokyo (Japan)	*a14*
GEC TELECOMMUNICATIONS, Coventry (England)	*a12-13*
GRANGER ASSOCIATES, Menlo Park (California — USA)	*a1*
GTE INTERNATIONAL, New York (USA)	*a30-31*
HASLER AG, Berne (Switzerland)	*a5*
HEKIMIAN LABORATORIES, INC. Rockville (Maryland — USA)	*a36*
HUGHES AIRCRAFT COMPANY, Culver City (California — USA)	*a8*
ITT — INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, Brussels (Belgium)	*a6-7* *a24-25* *a33,* *a36,* *a40,* *a44*
MARCONI COMMUNICATION SYSTEMS LIMITED, Chelmsford (Essex — England)	*a23*
MITSUBISHI ELECTRIC COMPANY, Tokyo (Japan)	*a42*
NEYRPIC Activités spatiales, Grenoble (France)	*a15*
NIPPON ELECTRIC COMPANY LIMITED, Tokyo (Japan)	*c2*
OKI ELECTRIC INDUSTRY CO LTD, Tokyo (Japan)	*a41*
PHILIPS TELECOMMUNICATIE INDUSTRIE, Hilversum (The Netherlands)	*a2-3*
PLESSEY TELECOMMUNICATIONS, Liverpool (England)	*a20-21*
GOUVERNEMENT DU QUEBEC, Ministère de l'Industrie et du Commerce, Montreal (Québec — Canada)	*a27*
ROHDE & SCHWARZ, München (Deutschland)	*a29*
SANDERS ASSOCIATES INC., Nashua (USA)	*a22*
SIEMENS AG, München (Deutschland)	*a16-17* *a28*
STS — SPA CONSORZIO PER SISTEMI DI TELECOMMUNICAZIONI VIA SATELLITI, Milano (Italy)	*a26*
TELETTRA S.p.A., Milano (Italy)	*a9-a11*
THOMSON CSF, Levallois-Perret (France)	*a32*
VARIAN EIMAC, San Carlos (California — USA)	*c3*
VICOM, Mountain View (California — USA)	*a19*
WANDEL U. GOLTERMANN, Reutlingen (Deutschland)	*a10*
ZELLWEGER, Uster (Switzerland)	*a18*

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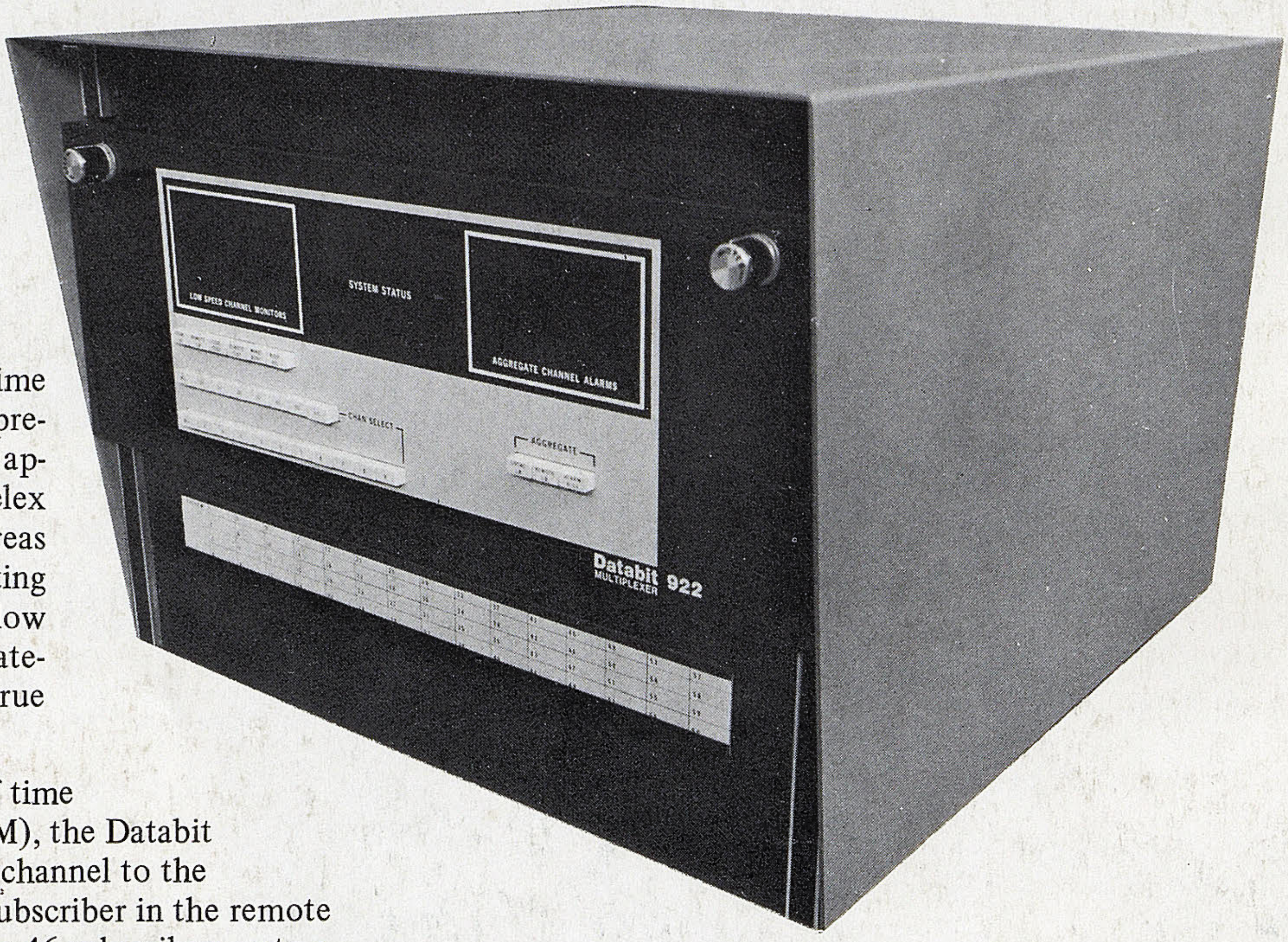

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